FISH, FUR AND GAME
IN THE NORTHWEST TERRITORIES

Report No. 2 To The
Legislative Assembly
of the Northwest Territories

Prepared By The
Science Advisory Board
of the Northwest Territories

September 1980

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Prepared by the:
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September 1980

Executive Summary

Fish, fur and game have for millenia provided the domestic needs of northern people. The introduction of European lifestyles and technology has had a powerful influence on the lifestyle and standard of living of northern residents but the requirement for country foods continues.

FUR

The total annual income from the sale of furs has increased in recent years. However, fluctuations in the price of furs and in the abundance of fur-bearers combined leave the fur industry in the Northwest Territories rather unstable. Despite extreme fluctuations several species consistently contribute the bulk of the revenue from the sale of furs. Seal, white fox and mink led in the early sixties; now, seal and white fox remain the leaders but the recent record prices for muskrat, coloured fox and lynx make them strong contenders for third and fourth rank importance. Several areas should be explored in order to improve returns to the fur industry. The proper handling of pelts should be promoted through an extensive trapper education program. A program of monitoring the lemming cycles combined with proper spacing of intensive trapping effort can increase, possibly double, the white fox harvest. Fall trapping for muskrat in shallow ponds that "freeze-up" in winter could substantially increase the muskrat harvest without reducing productivity the following spring. In order to increase and maintain a higher level of participation in the trapping industry, ways and means to buffer the trapper from drastic fluctuations in the fur market and numbers of fur-bearers should be implemented. A study of support price programs is recommended.

BIG GAME

Big game provides most of the subsistence red meat for native people in those communities that are not located on or near the sea coast. The non-coastal human population is 68% of the total. The coastal population is predominantly Inuit. The only non-coastal Inuit settlement is Baker Lake. Caribou provide most of the protein from big game sources. In order for caribou to meet their potential several significant changes in their management are required. Programs to restore herds like the Kaminuriak that has declined to a dangerous low must include reduced human kill and reduced predation by wolves. During the recovery of this herd, local people must be involved in procuring alternative supplies of protein and in administering and implementing the restoration program. Muskox hunting, following a 50 year ban, has expanded in a responsible and orderly fashion, as has polar bear hunting, following the adoption of a quota system in 1967. Further research into the distribution and productivity of both species will likely show that limited expansion of existing quotas is possible.

Moose do not meet the potential the species is capable of. Studies are required into productivity and optimum seasonal density over their entire range in the Northwest Territories. Habitat manipulation could increase moose productivity and should be part of an overall moose research and management program. As with caribou, current data on hunter kill are not reliable. Bison, like moose, could form an important part of the big game program. An excellent start has been made with the existence of a strong herd near Fort Providence and the recent introduction near Nahanni Butte. Further introductions are recommended. It is also recommended that the herd between the Slave and Taltson Rivers, infected with both tuberculosis and brucellosis, be eradicated and replaced with disease-free animals for the purpose of establishing a bison ranch there.

FISH

Freshwater fish are abundant in the Northwest Territories. Presently only 3.5 million pounds of the published total of 5.9 million pounds of commercial quotas is netted annually. It is estimated that the quota could be safely increased to 16 million pounds. Such an increase in catch would require that a transportation program be implemented to cover costs of fishing

remote lakes. It is recommended that arctic char be introduced to more productive southern lakes in an experiment to determine the possibility of culturing that species.

We also recommend a change to the Freshwater Fish Marketing Ordinance to permit local merchants to market, unhindered, fish caught locally and processed by approved methods. It is known that marine fisheries have a potential especially south and east of Baffin Island. We recommend extensive research into the development of that fishery.

MARINE MAMMALS

Marine mammals, especially the ring seal, provide much of the protein for people in coastal communities. Salvaging all the meat from existing marine mammal harvests would result in a surplus in many of the communities where the harvests occur. We recommend studies into methods of processing, storage and marketing so that less of the current marine mammal harvest taken for pelts, ivory or muktuk is left to scavengers.

FUTURE POTENTIAL

Protein supplies are probably adequate for about twice the 1980 population at the current level of protein intake. Population projections suggest that the number of people will have doubled early in the next century, and some time after that the demands of the growing population will exceed the sustainable yield even with the best possible management. Furthermore, our prediction is based on the introduction of efficient harvesting methods, with hunting pressure distributed over the entire range of a species, not concentrated around settlements and along major travel routes; reduced losses due to wounding; no increase in the amount of wild meat fed to dogs; and a threefold increase in the use of fish. A modest increase of 20% or so seems possible in the economic value of the wild fur harvest, but this too, would require a more uniform distribution of trapping effort and would support only a small number of additional trappers at a reasonable standard of living. With improved management and support with transportation the shortage in caribou might be made up by moose, bison or fish, depending on location.

Finally, only with a comprehensive and ongoing program of maintaining up to date information on wildlife stocks and harvests can the potential of any species be realized. Developing a system to provide accurate harvest statistics should be the first priority with continued inventories a close second. The increased harvests that such efforts will make possible will repay the investment in time and funds.

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Foreword

The Science Advisory Board of the Northwest Territories was established to help the Legislative Council to make the most effective use of science whether familiar or new to maintain or improve the way of life of all who live in the Territories. The renewable resources of the Territories are very important in contributing to the welfare of all inhabitants. Before contact with the white man these resources provided the core of the Inuit and Dene cultures. Many Inuit and Dene still live off the land and even those who have taken to urban life wish to retain the option of living off the land when and if they choose. Recognizing that the continuing availability of an adequate supply of country food was essential to any continuation of the traditional life, the Science Advisory Board began several years ago to assemble all available information that would shed light on the possible adequacy of country food supplies both now and in the future.

The first step in this process was to assemble information on the present human population and its probable future growth. This was done by a Canadian demographer, Louis-Edmond Hamelin, and was published by the Science Advisory Board (Report No. 1). It showed that the Inuit population has been increasing rapidly and the Dene much less rapidly. There is no certainty that these trends will continue nor is there any information now available that suggests that they will change drastically.

The next stage, which has proven to be very time consuming but also extremely useful, was to engage consultants to try to assemble all the scientific knowledge that could be found concerning terrestrial and marine mammals and fish in the Territories. This information has now been published in three reports as follows:

— Aquatic Resources in the Northwest Territories (Report No. 2)
— Arctic Marine Mammals (Report No. 3)
— Management of Some Terrestrial Mammals in the Northwest Territories (Report No. 4)

The present paper has been prepared by W. A. Fuller and B. A. Hubert of the Board in order to bring together in one paper of manageable size the salient points contained in the other three papers as well as to explore the adequacy of resource stocks to meet current and future needs of the Northwest Territories human population. It is hoped that this paper will serve as a basis for continuing discussions of the problems of fish and wildlife management in the Territories and as a basis for future planning by the Legislative Assembly. Several broad conclusions are immediately apparent but each one of them needs to be examined in more detail. The first is that our knowledge of the fish and wildlife of the Northwest Territories is inadequate. Our ignorance includes basic knowledge about most of the characteristics of the different species that are essential to intelligent management. Probably the biggest gap in knowledge is the extent of the domestic harvest, including for some species, losses during hunting. In many cases there is also serious lack of knowledge concerning reproductive cycles and even simple estimates of abundance.

Probably the most important conclusion that appears is that time has not yet run out. For all but a few species there are adequate populations to meet present needs and in most cases the harvests can almost certainly be increased by better management. In cases such as the bison there are opportunities for greatly increasing the harvest. It seems certain that many of the Inuit and Dene can continue to live off the land. They must however become actively involved in resource management. Intensive management can increase substantially the fish and wildlife that can safely be harvested.

However, we must not be carried away by this present optimism. The number of Inuit and Dene is increasing and the productivity of arctic ecosystems is low and sharply limited. Therefore, sometime in the not too distant future, the limits of productivity will be reached. Also the Inuit and Dene have abandoned their nomadic habits and no longer move seasonally

to find game. Most of them live in settlements the locations of which were chosen by others for ease of accessibility from the South rather than for the abundance of local resources. If the people do not follow the game then new arrangements must be made for getting the product of the hunt distributed to the people. There is clearly need to put renewed emphasis on the effective distribution of country food within the Territories.

This report does not carefully examine the economic implications of the knowledge that it portrays. However, it is clear that the economic importance of fish, game and furs can be greatly expanded and should not be ignored in the current efforts to diversify and expand the economy of the Northwest Territories. It is hoped that future studies by the Science Advisory Board and other agencies will examine these possibilities and point the way to improved productivity from these renewable resources and a much greater involvement of the Inuit and Dene in all aspects of their management.

O.M. Solandt
June 1980

Introduction

The discovery of oil at Prudhoe Bay, Alaska, and the subsequent oil and gas play in the Mackenzie Delta - Beaufort Sea area, were the culmination of a historical process in which interest in renewable resources had given way to interest in non-renewable ones. The Berger Commission hearings and report, however, revealed a deep, underlying concern over the future of renewable resources on the part of many people, and encouraged a perhaps overly optimistic view of their ability to support traditional life styles. In an attempt to put this whole question into perspective, the Science Advisory Board commissioned studies of the human population and of the renewable resources of fish, fur-bearers and game mammals. This report attempts to analyze and summarize the Board's studies, all of which have now been published.

Fish and wildlife resources serve several functions in the life and economy of the Northwest Territories, and, given careful management, they can continue to serve those ends in perpetuity. It is this feature of renewable resources that distinguishes them from the non-renewable energy resources and the finite deposits of other minerals. Even the richest vein and the largest oil field has a productive life measured in decades, not millenia. It is important, therefore, that in our haste to extract minerals, we are not blinded to the long term economic, cultural and esthetic rewards of renewable resources.

Fish and wildlife are obviously important in providing food, clothing and other subsistence items to those desiring to live off the land in the traditional manner. Their second obvious function is to provide income, through the fur trade, commercial fishing, and sale of other items. A small industry, possibly capable of expansion, caters for sports hunters and fishermen. Almost ignored, so far, have been the non-consumptive, esthetic values of wildlife, although the north still has some of North America's greatest wildlife spectacles to offer. Finally, we must remember that humble species, not directly used by man, have important roles to play in ecosystems. This should remind us that polluted waters may lose their fish populations, and denuded landscapes may shelter no game.

In this report we emphasize the importance of wildlife as a source of income and food, and we attempt to assess the potential of wildlife resources to support an increasing human population in the traditional manner. In this respect we must keep in mind several things over which we have little or no control. First, the 1976 population of the Territories as a whole is likely to double, to about 100,000 people, early in the next century, and the Inuit population, considered separately, will reach double its 1976 numbers before the century is out. Second, cosmology, geography and geology impose severe constraints on biological productivity over vast areas of the Northwest Territories. Up to half of the year's supply of life-giving sunlight may fall before land and lakes are free of snow and ice. The entire land surface was wiped clear of soil by Pleistocene glaciers, and the time since deglaciation has been too short to permit development of a new soil mantle. Low summer temperatures, especially north of the tree line, impose slow growth rates on plants and animals alike. Cold soil, especially where there is permafrost, interferes with the functioning of plant roots and slows down decomposition and recycling of nutrients. Further information on these points will be found in the Board's reports Numbers 1-4.

There are but few people living in the Northwest Territories today whose sense of well-being either physical or mental is not affected by the fish, game or marine mammal species of the Northwest Territories in their wild state. This paper is intended to summarize our collective uses of these resources and to comment on their potential for the future. We will try to describe what we consider will be a responsible course of action to follow in order to ensure that the human and biological elements of the hunting, fishing and trapping sectors of the Northwest Territories economy remain productive.

HISTORICAL BACKGROUND

Fish, game and fur resources played a role in northern aboriginal societies similar to their role in the growth of societies in other locales where agriculture was not practiced and the population was totally dependent on availability of those resources for survival. Not until the arrival of Europeans, and their exploitation of wildlife for commercial purposes, did the role of those resources in aboriginal society change. For a time the pursuit of fish, fur and game did not threaten either the resource or the society that had hitherto been dependent on it, but, as new technology was introduced it was not long before the resource harvester experienced the effects of over use. Scarcely 50 years after trading posts were first established, beaver and musk-ox had become so scarce in the Northwest Territories that action to protect them had to be taken. Wood bison were thought to have become extinct, beaver could be trapped only under quota, caribou herds were declining and local lakes were being overfished. The relative importance of man and natural forces in these events cannot now be demonstrated because of imprecise and unreliable records. Records that are available, however, can show changes that have occurred in the last two decades.

Fur Production

For the purposes of assessing the potential of the trapping industry we will use 20-year averages developed from data collected between 1957/58 and 1976/77 (Appendix I) supplemented by returns for 1977/78 and 1978/79. Species will be discussed in order of their economic importance. Polar bears are discussed in this section because the non-esthetic rewards of harvest come primarily from the sale of their pelts, not from their use as food.

SEALS

Almost all seal pelts produced in the Northwest Territories come from two species - harp seals and common or ringed seals.

Harp seals are harvested by communities along Davis Strait, Hudson Strait and Lancaster and Jones Sounds. Their migratory habit makes them a seasonal resource that is shared with communities in Northern Quebec, Labrador, Newfoundland and Greenland. Scandinavians also participate in the annual east coast seal hunt offshore. Northern hunters take harp seals primarily for their pelts, although edible parts remain an important food source.

Ringed seals are available to all coastal communities of the Northwest Territories. They are important for their commercial value and domestically for food and clothing. Since they are non-migratory, and they are able to maintain breathing holes in shore-fast ice, they are available year round.

MARKETING STRATEGIES

Seal skins were the leading fur in dollar terms in 9 out of 16 years beginning with 1961/62. Data for earlier years are not available.

Nevertheless, there was almost a total collapse in the sealskin market during 1977/78. Annual exports ranged from 10,470 for 1961/62 to 68,332 in 1964/65. The average annual price per pelt during the same period varied from $4.65 to $23.65.

The relative importance of the several seal species, where more than the ringed seal occurs, is shown by harvest data for all Baffin Island communities combined for 1978/79. Of the 23,699 pelts reported, ringed seals accounted for 20,601, harp seals for 2,066 and all others (bearded, hooded and harbour seals) for 1,032 (R. Tinling, N.W.T. Wildlife Service).

Following the collapse of the market for seal skins in 1978, concerned hunters and government officials struck a committee to explore ways of renewing this valuable cash source for Inuit communities. ***Kissiliriyeet*** (Inuktitut for "the ones who deal with seal skins") soon found that a major weakness in the market for northern seal pelts was variability in pelt quality. The most significant single contributor to reduced quality of many northern pelts was poor handling. Many pelts had excessive fat and oil residue on them. It appeared also that the northern seal market had been affected by the anti-sealing campaign directed at the annual controversy over the harvest of harp seal pups. ***Kissiliriyeet*** has mounted an information and education program to attack both problems. If, through such efforts, the average price per pelt were to increase by only one dollar, the increased return to the Baffin communities in one year would repay the cost of the program. Similar programs dealing with the preparation of all other furs ought to be conducted throughout the N.W.T.

RESEARCH AND DATA GAPS IN SEAL MANAGEMENT PROGRAMS

It must be stated at the outset that research and management of seals, and all other marine mammals in Canada, come under the Fisheries Act. The federal government agency responsible is the Fisheries and Marine Service of the Department of Fisheries and Oceans.

The single greatest weakness in the entire seal management program is lack of accurate harvest data. Smith and Taylor discussed this weakness and made suggestions for improvement as early as 1977. To date we are unaware of any improvement in the quality or quantity of harvest data collected.

Another serious weakness in the current seal management program is lack of precise data on population sizes and trends. Although significant improvements in our understanding of life histories and reproductive capacity of both harp and ringed seals have been made in recent years, the management of both species would benefit from better and more consistent population studies. Studies are needed to determine what proportion of the whole population of harp seals occupy Northwest Territories' waters in summer, and whether herds that return to the same areas each year are composed of the same individuals. These data, along with accurate harvest statistics, would form the basis for a management program for harp seals in the Northwest Territories, independent of the quota set annually for the "front" off Newfoundland and Labrador.

it is clear that population figures available from ringed seals are at best crude estimates. Consequently the manager has no reliable guide to optimum harvests.

These two serious data gaps are further exacerbated by the total lack of data on hunting losses due to sinking. This problem, which accounts for mortality over and above that reported in fur records, is discussed further in "Arctic Marine Mammals" (Science Advisory Board Report No. 3). Losses as high as 50% have been recorded for ringed seal hunted during the open water season. The uncertainty of such losses reduces the utility of harvest data in developing a management program. The importance of seal pelts in the economy of Inuit communities dictates that an effort be made to reduce losses and improve records in order to obtain greater benefits from the resource.

The other seal species occurring in northern waters -bearded, hooded and harbour seals - play a minor role in the economy of Inuit communities in the Northwest Territories. Bearded seals, are used almost entirely for the local manufacture of boots, mitts and other leather products, especially lines. Harbour and hooded seal pelts make up a small portion of the total seal catch.

WHITE FOX

White foxes (and their blue color phase) have been trapped in all parts of the Northwest Territories. Their occurrence in the extreme southwestern portion of the Northwest Territories is sporadic and of little economic significance, nevertheless, they appear in the catch records of Fort Liard and Hay River.

The cyclic nature of white fox abundance is clearly seen in the 20-year catch records (Appendix 1). Also evident is the unpredictability of both abundance (if the catch is an indication) and fur prices. Statistical tests show that there is no relationship between the size of the annual catch and the prices per pelt (Table 1). Over the Territories as a whole annual catches have fluctuated over 600% and in individual settlements the range has been even greater. For example, in 1942/43 the white fox catch in the Western Arctic (Banksland, Aklavik, Tuktoyaktuk and Paulatuk) totalled 16,126 while 6 years later it totalled only 887 (Usher 1974). In the 20 years following 1957/58 the average annual price per pelt fluctuated over 400%, nevertheless white fox led Northwest Territories fur sales in eight years. (Sales of sealskins are not available for the years 1957/58 to 1960/61).

Catch records kept since the 1920's and summarized by Peter Usher in 1974 show that average annual catches were higher then than now. For example, the average annual catch from 1940/41 to 1944/45 was 41,600, whereas the average annual catch in the 20-year period ending in 1977 was 23,390. The average of the five highest annual catches for the same 20-year period was 35,717 pelts. There is no evidence to suggest that the cause of the decreased catch is decreased abundance. There is evidence however to suggest that trapping efforts have decreased. Based on the averages cited above, the harvest could probably be doubled without serious impact on the productive capacity of the species. With spacing of harvesters in response to density and abundance of foxes, the harvest might be increased further still.

MANAGEMENT NEEDS

The relationship between white fox abundance and lemming cycles has been well documented. The trapper and manager collectively could develop a useful and meaningful forecasting capability by monitoring lemming densities around fox dens, from which the relative abundance of foxes could be predicted well in advance of the onset of the trapping season. Fur prices are usually known and their trend understood by early December. If both indicators point towards a favourable year there would be sufficient time remaining in the trapping season for the manager to provide incentive to trappers to intensify or redirect their efforts. If only one indicator is up then the manager should only encourage experienced and full-time trappers. If both indicators are down the manager might consider cutting off all incentives. Foxes have a tremendous reproductive capacity and it is unlikely that the effects of one year's over-harvest would affect trapping success for more than one or two subsequent years.

MUSKRAT

Muskrat are trapped or shot by residents of Tuktoyaktuk and all communities in the Northwest Territories south of the treeline. In 4 years during the 20-year period between 1957/58 and 1976/77 the sale of muskrat pelts brought more cash to the Northwest Territories economy than the sale of any other fur. As with fox, both the market and the abundance of rats fluctuates. The range in annual catch during the 20-year period was from 46,106 for 1972/73 to 276,518 in 1976/77. The average annual price fluctuated from $.48 per pelt to $3.07 per pelt in 1957/58 and 1976/77 respec-

tively. Despite record-setting prices in 1978/79, the catch was below the 20-year average. A serious outbreak of tularemia in both the Slave and Mackenzie River Deltas in the spring of 1977 may have contributed significantly to the reduced catch in 1978/79.

The factors that cause muskrat populations to fluctuate are not understood, nor is there general agreement on the effect of trapping. Experience in the Mackenzie Delta suggests that a decline in abundance is not necessarily followed by a decline in harvest. Between 1962 and 1963 Hawley documented a decline of 90% in overall muskrat abundance, but the catch during the same period declined by only 50%. This suggests that the harvest might be increased considerably without damage to the productivity of the population.

Trappers, especially those that do not harvest rats on a regular basis, should be encouraged to handle pelts in the best possible manner. Perhaps audio-visual materials could be prepared and made available to demonstrate and promote the best techniques of pelt preparation.

MANAGEMENT NEEDS

During the past 20 years muskrats harvested by residents of Fort Smith, Fort Resolution, Fort McPherson and the Mackenzie Delta, including Tuktoyaktuk, contributed up to 70% of the total Northwest Territories catch.Those rats are produced primarily in the deltas of the Slave and Mackenzie Rivers and immediate vicinity. Obviously, efforts to improve production and harvest in those areas will have a more significant effect than efforts directed elsewhere on the muskrat's range in the Northwest Territories.

Several areas of research could contribute toward increased harvests. Muskrat production is very sensitive to water levels. As early as 1953, Dr. Stevens of the Canadian Wildlife Service, found that shallow lakes (less than 6 feet in depth) in the Mackenzie Delta froze solidly in winter. That being the case, the overwintering mortality of muskrats there is very high. A systematic survey and mapping program giving the elevation and water depth of each pond would identify water bodies that should be "trapped-out" in fall and early winter without affecting spring production. Careful correlation of pond depth and elevation with existing water levels could also reduce the amount of unproductive effort on the part of trappers who harvest in areas of very shallow, or otherwise marginal habitat. By following such trapping schemes it may be possible to more than double harvests without increasing trapper density, or having a negative effect on productivity.

Debate over the merits of trapping, versus shooting of rats in spring, continues. Those advocating trapping use reduced losses and improved pelt quality in support of their argument, while the harvester who shoots rats insists that it is cheaper and more productive.

MARTEN

Marten are found in all forested parts of the Northwest Territories. Most marten are taken by trappers in the mid-Mackenzie Region - Forts Norman, Franklin and Good Hope - where marten is the most important fur. The annual catch between 1957/58 and 1976/77 varied between 3,856 and 18,814, but from 1975/76 to 1978/79 the catch increased from 7,711 to 23,309 (Appendix I).

Marten are easily trapped, which means good returns to the trapper for a minimum of effort, but it also means that care must be taken that local stocks are not depleted, as has happened in the immediate vicinity of several Mackenzie River communities. Although average annual prices from 1957/58 to 1976/77 fluctuated between $6.51 and $24.40, there is no statistical evidence that price influenced catch (Table 1). However, addition of data for 1977/78 and 1978/79 converted slightly negative correlation coefficients to positive ones, which suggests that the extraordinary price increase was an incentive to intensify trapping effort.

MANAGEMENT NEEDS

Hawley in 1968 suggested that trapping effort could increase in some areas. The increases already alluded to will provide a test of his prediction, and a careful watch on stocks and harvests in the next few years seems to be a prudent step.

Studies should also be conducted to determine optimum density of traps, optimum distribution of trappers in major habitat types, and the best trapping seasons at different latitudes.

POLAR BEAR

Polar bears are hunted primarily for the cash value of their pelt, although a limited amount of the meat is used as food for both people and dogs. The quota of 593 for 1979/80 was divided among 31 Hunters' and Trappers' Associations representing communities and

associated hunting camps. The size of the local quota is based on historical bear harvests and biological information. The polar bear quota system was introduced in 1967 when a quota of 400 was set. Since then the diligent efforts of biologists employed by both the Government of the Northwest Territories and the Canadian Wildlife Service have produced data supporting the increased quota.

Over the 20-year period the combination of increased quotas and prices has produced a dramatic increase in the value of the polar bear harvest. Up to 1971 the value of the harvest never exceeded $100,000 per year, whereas the cash value of 466 pelts in 1978/79 exceeded $508,000.

MANAGEMENT NEEDS

Despite the continuous efforts of biologists several serious data gaps remain. The abundance and relationship of bears in Foxe Basin to those of Hudson Bay has received little study as has the sub-population of bear in the western portion of the Northwest Passage. Considering the cash value to the local economy of each bear killed, it is important that quotas be set in response to biological data, not local demand. However, it is equally important that the quota does in fact permit the allowable harvest. In order to achieve the confidence required in setting such quotas a greater understanding of the ecological relationship of polar bear is required.

The polar bear is a near-shore species. Although generally considered a land mammal, its ecological medium is more like that of seals than that of other bears. Its main prey in the Northwest Territories - the ringed seal - is also a non-migratory, near-shore species whose abundance and productivity seem to be influenced by ice conditions.

The abundance of polar bears in the Beaufort Sea declined in the mid-1970's following a decline in seals, which was in turn attributed to abnormal sea-ice conditions. It is important to learn whether the decreased abundance of bears was caused by decreased survival, reduced productivity, emigration, or some combination. Furthermore, it is important to know how, and how quickly, both seal and bear populations recover from periods of reduced abundance. Only then can maximum allowable but biologically safe, quotas be set by the manager. That quota may well be higher than the current figure of 593 bears per year.

Harvest data suggest that pregnant females would benefit from a delay in the opening of the hunting season from 1 October to 1 January, which would permit them to "den-up" in safety. If the predicted increase in gross productivity were substantiated by experience, local quotas could be increased. This has been done in several Baffin communities; in others however, this change remains the subject of discussion. This technique could not be used by communities dependent on migratory bears, which are only accessible during fixed periods.

MINK

Mink are trapped throughout the forested portions of the Northwest Territories. They appear to be most abundant in areas of high populations of muskrats, which are their principle prey, and are trapped in the greatest numbers there.

Although mink are not trapped in great numbers, their economic importance lies in the consistently strong price paid for their pelts (Table 1). The average annual price between 1957/58 and 1976/77 ranged from $11.34 to $27.07, but it reached $36.07 in 1978/79.

MANAGEMENT NEEDS

Since mink respond in part to muskrat abundance, little in the way of direct research can improve the managers' ability to promote optimum harvests without reliable data on muskrat populations. A strong and aggressive program of muskrat population research and monitoring however should provide sufficient data on mink abundance on which to base harvest regimes.

In those areas of the Northwest Territories that do not support large muskrat populations mink nevertheless occur in moderate numbers (Yellowknife, Rae-Edzo). Because their primary prey in these areas is fish, the amount of open water at rapids and falls probably influences winter abundance and distribution. A program of regular winter trips over the same trail observing and recording sign should provide information on relative abundance sufficient to detect long term population trends.

BEAVER

Beavers are caught only by trappers in the forested portions of the Northwest Territories. Originally the most sought after pelt, beaver now accounts for less than 5% of the total fur income in the Northwest Territories. (In 1978/79, 6,278 beaver pelts brought $150,476 out of a total fur income of $5,745,452.). However, beaver is still very important for communities along the upper Mackenzie and Liard Rivers.

Trappers from Hay River, Fort Simpson and Fort Liard caught over 40% of the total beaver harvest in 1978/79, while the total combined catch at Fort Good Hope and Fort Franklin was 22% of the total of 6,278 pelts. In those five communities the cash value of beaver was exceeded only by that of marten.

Over the last 22 years, beaver has been the most stable of all major fur-bearing species, both in numbers harvested and in cash value (Table 1). There has also been a significant negative correlation between numbers harvested and average price paid per pelt, i.e., when the harvest goes up the price goes down, and vice versa.

MANAGEMENT NEEDS

Beaver are very susceptible to over-harvesting, especially in the Northwest Territories where much of their range is marginal habitat. In response to this, a significant amount of inventory and research has been conducted, much of it dating back to the early 1950's, (Fuller, 1953; Stevens, 1953; Novakowski, 1967; Hawley and Aleksiuk, 1973; Boles, 1975), which provided data on colony densities and sizes along the entire Mackenzie System within the Northwest Territories. It is doubtful that a renewed research program would greatly enhance beaver management in the Northwest Territories. However, in the Hay River, Fort Liard, Fort Simpson, Fort Franklin and Fort Good Hope districts, inventories should be reinstituted so that harvests can be compared with lodge densities to re-establish a baseline from which to promote optimum harvests.

LYNX

Lynx distribution is restricted to the forested portions of the Northwest Territories. They are trapped in greatest numbers around, and south of, Great Slave Lake. Their abundance is directly related to that of snowshoe hares, on which they prey. Both species reach a peak of abundance, at any given point, about once per decade, with hares peaking about a year earlier than lynx. However, since hare cycles are about a year out of phase between the upper and lower Mackenzie Valley, good catches over the Northwest Territories as a whole are spread over about 3 years (Appendix 1; 1960-63; 1969-72; 1979-?). The rise and fall of numbers in the harvest is clearly a function of availability, which is totally unrelated to price (both Pearson's and Spearman's correlation coefficients are 0.04, Table 1). Note also that 4,959 were taken in 1961/62 at an average price of $7.23, whereas only 581 were taken in 1975/76 at an average price of $163.07. If the "law" of supply and demand were at work, with high prices at low abundance and vice versa, correlation coefficients would be strongly negative, which they are not. Price, therefore, is determined by other factors, such as the dictates of fashion.

The record price in 1978/79, combined with a population at or near a peak, provided a bonanza for Mackenzie Valley trappers.

MANAGEMENT NEEDS

As with other cyclic species little in the way of research can enhance the management of lynx. A simple monitoring program of hare and lynx relative abundance could provide information of a predictive nature useful to the manager and trapper.

WOLF

Few individuals actively pursue wolves only, but rather take them incidentally in the course of hunting and trapping other species. Fur export statistics provide an underestimate of the harvest because pelts are used extensively on locally manufactured garments. Prior to 1975 a $40.00 bounty was paid for every wolf killed in the Northwest Territories. A carry-over from a wolf control program initiated in the 1950's, there is no evidence that it had any long lasting effect on wolf populations. It did however guarantee a minimum price to the harvester and so supplemented his income during a period when fur prices were generally low.

Both harvests and prices have undergone marked fluctuations over the past 22 years (Appendix 1). Even with the confounding effect of the bounty payment there is a strong positive correlation between price and catch (Table 1; the probability of getting such high correlations by chance alone is less than one in a hundred).

This suggests (but does not prove) that trappers will intensify their efforts to get wolves if the price is sufficiently high.

MANAGEMENT NEEDS

The basic life history of the wolf has been studied and documented. Little in the way of additional research is required to enhance the value of the wolf as a resource species in the Northwest Territories. However considerable research is required to understand and manipulate the role of wolves in the management of caribou and other prey species.

RED AND CROSS FOXES

Colored foxes were an important part of the fur trade in the 1920's and 1930's, but as a result of competition from fur farms and then the decline in popularity of long-haired fur, they became, literally, worthless in the 1940's. They remained unpopular until the 1970's when prices began to rise (Appendix 1). By 1978/79 the value of the harvest of both color phases combined was over $480,000.00 which is more than the total value of all colored foxes sold from 1957/58 and 1977/78. When the silver color phase is added to the total, the value exceeds half a million dollars, and colored foxes rank fifth in value, just behind polar bears, among all fur-bearing species.

Colored foxes demonstrate the closest association between catches and prices of any species examined (Table 1). The probability of getting such high correlations by chance alone is less than one in a thousand. This suggests that trapping effort is related to price, which in turn suggests that the low catches until about the mid 1970's bore no systematic relationship to the size of the populations from which they were taken.

MANAGEMENT NEEDS

No specific suggestions are made, other than to note that as long as fashion favors long-haired furs, colored foxes should receive more attention than they have in the past.

SQUIRREL AND WEASEL

These two species, although totally unrelated biologically, have several things in common. They are small species, often found close to human habitation; the price of an individual pelt is not great; they are frequently pursued by older, less mobile people, and by boys too young to go with their fathers on a full-sized trap line. In actual number of pelts taken, squirrels rank fourth and weasels eighth, just behind mink and well ahead of colored foxes and wolves. In terms of stability of harvest they are about on a par with white fox, marten, mink and muskrat. Prices for both have been remarkably stable (Table 1; the variation in squirrel prices is heavily influenced by a 240% increase in 1978/79). In both species harvests are negatively correlated with prices. The relationship is on the verge of statistical significance for squirrels (less than one chance in twenty of occurring by chance alone), but may be a chance occurrence for weasels (probability about 30%).

MANAGEMENT NEEDS

There is no evidence that either species requires special measures at present.

OTHER FUR-BEARING SPECIES

The remaining species taken in the Northwest Territories contributed less than 2.5% of total sales in the period 1957/58 to 1976/77. Furthermore, none of the species (black and grizzly bear, coyote, fisher, otter or wolverine) made up a significant portion of the catch in any particular region. Also, none of these species is threatened by extinction as a direct result of current rate of harvest by man.

SUMMARY

To attempt to assess trends in the fur industry, we made two comparisons. First, we compared the value of the catch in 1976/77 with that in 1957/58, after adjusting for changes in the value of the dollar. In view of the erratic nature of some of the changes in both numbers of pelts and their average value, comparisons between individual years should be interpreted cautiously. However, in spite of the decline in numbers of furs taken, the cash value of the 1976/77 harvest was about two and one-half times that of the 1957/58 harvest. To make the comparison meaningful we need a measure of the amount of trapping effort in order to determine whether the average trapper was better off in 1977 than in 1958, but these data are not available for 1958. We point out, as well, that there was a large increase in the value of fur produced in 1978/79 over 1976/77 (again in constant dollars).

We also compared two 5-year periods, which helps to even out some of the larger year to year fluctuations in harvest and price (Table 2). Several points are brought out by this analysis, which are worthy of note. First, although seals led in value over the 20 years as a whole, they did not rank first in either of these 5-year periods. Second, most catches went down. Seals, wolves and colored foxes went up, and white foxes remained at about the same level. Third, all prices per pelt are up (in constant dollars) except those for mink, which failed to keep pace with increases in the CPI. As a result, mink fell from third place to eighth in the rankings. Beaver prices just kept pace with the CPI and beaver fell from fifth to ninth place in overall importance. Finally, overall, the value of the industry increased by about 40%, but about one-third of that was due to the dramatic increase in the price of polar bears alone. In spite of our crude attempt to average out the CPI over 5 years, this index is probably closer to the mark than the 250% increase implied by the single year comparison.

The potential of the fur harvest in the Northwest Territories is greater than the current catch. For example, if by intensive management the average annual catch were to increase to that of the maximum annual catch for major species, like white fox, muskrat and marten, the cash return to the trapping sector in 1976/77 would have increased by $860,000.00 - a 20% increase for the entire industry.

If through better handling and processing the average value of each pelt harvested were to increase by just $1.00, the average annual return would have increased by another $250,000. By combining improved handling and intensive management it might have been possible to add 1.1 million dollars to the value of the trapping industry in 1976/77, and to maintain this enhanced value thereafter.

CONCLUSIONS

1. Contrary to the opinions of some, the trapping industry has more than kept pace with changes in the Consumer Price Index. This has been brought about, however, by increases in the average price per pelt (for all species except mink) which has more than offset reduced catches of most species. Tentatively, we suggest that the reduced catches are a function of reduced trapping effort rather than reduced stocks and therefore lower productivity. However, the rapidly expanding catch of marten, especially, bears careful watching.

2. Point 1 brings out the overriding importance of price for management of several important species. Based on the Coefficients of Variation (Table 1) only three species have less variability in average annual price than in numbers harvested (beaver, mink and weasel). A numerical example may help to clarify the role of price. The mean value of the average annual price paid for white fox over the 22 years analysed was about $18 (Table 2) and the ratio of the highest to lowest average annual price was about 4 - from about $9 to more than $36. If a trapper expects to get around $18 per pelt for his foxes, he knows he can make a living on a catch of a certain size, but if the price falls to $9, he will be driven to try to double his catch, in order to keep his income constant, whether or not it is biologically safe to do so. If, on the other hand, the price doubles to $36, the trapper can either maintain a constant income for half the effort, or, he may be induced to trap heavily in order to make a "killing", again without regard to the biological wisdom of doing so. Assuming that the number harvested is a rough index to the size of the stock from which the harvest is taken, it is evident that stocks fluctuate in size - by factors of 4-10 in most cases. So the trapper can be faced not only with a 50% reduction in price, but with a 50% reduction in harvest as well. Occasionally, as with lynx in 1978/79, the opposite happens and both prices and numbers go up simultaneously. For most species, prices and numbers fluctuate independently of each other (cor-

relation coefficients not significantly different from zero).

We recommend a thorough study of the economics of the fur industry, with a view to reducing the economic uncertainty that the trapper faces. Management of stocks alone cannot accomplish that end.

To put the effect of these recommendations into perspective, it is necessary to review the numbers of trappers contributing to the annual catch. In 1975/76, 1976/77, 1977/78, 3,415, 4,089 and 3,679 sold furs respectively. The total sales were 2.8, 3.9, and 3.4 million dollars for the above mentioned years respectively. These data plus those summarizing the ranges in trappers incomes are provided in Table 3. Under prevailing conditions, following the recommendations made above, the industry could generate as much as an additional million dollars annually. To divide this additional income evenly among all trappers might not benefit the industry.

The increased harvest must come from currently unharvested territory. The reduced trapping pressure resulting from "transplanting" several trappers could also have a beneficial effect on those trappers remaining in the traditional trapping grounds. Numerous alternatives are available for the manager to pursue. One principle however must be kept in mind – the annual production of fur is limited and continued unregulated harvest from the same areas does not constitute management. Intensive management however of fur bearers over their entire range in the Northwest Territories can continue to provide for a living for a significant number of trappers. The introduction of guaranteed floor prices, for major fur-bearing species, indexed to the market, inflation and abundance (for cyclic species) could result in a stable and productive industry. We recommend that an intensive review be made of such a price stabilization program.

Meat Production

BIG GAME

CARIBOU

Caribou of one form or another inhabit most of the mainland and islands of the Northwest Territories. Barren-ground caribou occur in most areas east of the Mackenzie Valley to Hudson Bay and Baffin Island, and west of the Mackenzie Delta. Woodland caribou are found around the west end of Great Slave Lake, in the Mackenzie and Liard River Valleys and in the Mackenzie Mountains. Peary caribou occur on many of the arctic islands. Barren-ground caribou interbreed with the other subspecies where their ranges overlap. Semi-domestic reindeer have been introduced to the western arctic near Tuktoyaktuk and to the Belcher Islands. For a thorough summary of the range and population status of caribou herds in the Northwest Territories, the reader is referred to a paper prepared for the Northwest Territories Wildlife Service in 1979 by George Calef and to Science Advisory Board Report No. 4, Management of Some Terrestrial Mammals in the Northwest Territories.

BARREN-GROUND CARIBOU

Approximately 500,000 barren-ground caribou occupy the Northwest Territories in all or part of their annual cycle. Although harvest records are incomplete Calef, (1979) estimated that 20,000 were killed annually. This amounts to 4 % of the total. Harvest estimates for individual herds range from virtually nil in the Wager Bay herd to 10-15 % for the Kaminuriak herd.

In the Northwest Territories barren-ground caribou can be hunted by any resident 16 years of age or older. With few exceptions the caribou harvest by persons holding General Hunting Licences (predominantly but not exclusively natives) is unregulated. Other residents must adhere to seasons and bag limits. Holders of General Hunting Licences can sell the meat of caribou from specified areas in amounts regulated by quota. Persons not resident in the Northwest Territories can hunt caribou only on retaining the services of a resident guide.

Perhaps no aspect of wildlife management in the Northwest Territories has sparked more controversy than the status of barren-ground caribou. From repeated aerial census combined with herd composition data indicating the number of young animals entering the breeding population, wildlife biologists believe that several herds are being over harvested and that there is no room for increased harvests for most other herds. On the other hand, the hunter on the ground sees caribou at about the same *density* year after year. Having no means to determine the total area occupied by a herd, he concludes that there has been no change in total numbers. Confronted with evidence from aerial counts, the hunter logically concludes that, since he saw no change in density, if a decline has occurred, it must have been caused elsewhere by some other agent such as predators, industrial activity, or hunters at some other location. This confrontation is reaching a critical point with no rational solution in sight.

Decisions made in the 1980's will determine the fate of barren-ground caribou in the Northwest Territories well into the next century. Caribou management in the Northwest Territories is at the crossroads. On the one hand, we can ensure that caribou remain the foundation of the domestic economy for most communities as well as an essential element in the culture of native society. On the other hand, if the current passive approach to both predation and hunting continues through the 1980's, barren-ground caribou in the Northwest Territories will suffer the fate of the whooping crane and bowhead whale - neither extinct nor available as an exploitable resource. The monetary cost of either alternative to government will be about the same, while the cost (cultural and dietary) of losing the caribou is incalculable. Consider for a moment the implications of no caribou for the people of Baker Lake!

MANAGEMENT NEEDS

Despite continuous research into the unknowns of caribou ecology for several decades, some very basic questions remain. Of the thousands of calves produced every spring, less than half survive to the fall. We do not know the relative importance of the factors responsible. The relationship between caribou and wolves has not received the attention it deserves. The fundamental question is whether caribou populations can withstand uncontrolled predation from wolves and continue to provide an adequate meat supply for human use.

If the allocation of funds provided for barren-ground caribou studies is an indication of the management priorities of government (both federal and territorial), it

is safe to conclude that the data necessary to manage caribou for optimum sustained yields will not be in place in time to serve that purpose. Significant amounts are spent on impact and disturbance studies in response to industrial activities. While these studies may contribute to the management of such activities they are of little value to the long term management of caribou. Furthermore it remains to be demonstrated, in fact or in theory, how site specific industrial activity is a factor responsible for barren-ground caribou mortality on the scale observed on all parts of their range in the Northwest Territories.

We cannot over-emphasize the need to study and evaluate the principle agents directly responsible for caribou mortality - wolves and bullets. Furthermore, both can be regulated through decisive action by the Legislative Assembly. The State of Alaska has demonstrated that declines of disastrous proportions can be reversed in a short span of time.

The response of the State of Alaska to the decline of the western arctic herd was to ban all hunting of female caribou and restrict the hunting of males. Also a large scale wolf hunting program was launched. The results were dramatic - between 1970 and 1976 the herd declined from 250,000 to an estimated 70,000. In response in part to the measures described above the herd is recovering and stood at 113,000 in 1979. Similar results are possible for herds in the Northwest Territories that are currently declining. After many years of study, John Kelsall, in 1968, stated that the potential carrying capacity of the barren-ground caribou range in the Northwest Territories is 2.4 million animals. A combined program of wolf control and carefully regulated hunting is required to achieve Kelsall's predicted number. Critics who oppose such a program because of the wolf control element must keep in mind that the most effective way to eradicate wolves is to eliminate caribou. Similarly, the harshest natural disaster short of fire or earthquake to befall many native communities would be the elimination of caribou from their diet, economy and culture. The trends of three herds in the Northwest Territories are pointed in that direction.

In cases when the domestic harvest of caribou must be sharply curtailed in order to implement a caribou recovery plan, an alternate supply of protein must be made available to maintain the nutritional well-being of the people. Furthermore the people affected should be actively involved in procuring that protein. Similarly they must be involved and participate in all aspects of the caribou restoration plan.

The productive potential of a herd that receives little hunting and no predation is demonstrated by that on Coats Island in Hudson Bay. The cropping rate there could almost equal the birth rate of about 23% of the winter population. A further increase in harvest might be possible if the sex ratio of adults was deliberately manipulated to provide about three females per male. The winter population of Coats Island peaked at about 4,500 twice during the 1970's, which implies a maximum harvest of between 900 and 1,800 animals or 60,000 to 120,000 kg of meat, or a cropping rate of 9-18 kg per km^2. Similar production might be achieved on Southampton Island as well. Such intensive management requires a careful monitoring and research program to determine the carrying capacity of the island during those climatic conditions responsible for the periodic population declines observed on Coats Island since 1970.

Mainland populations, which have predators, could not be cropped at such high rates without some form of predator control. Without predator control it might be possible to harvest 10% of the winter population annually, which is about twice the current estimated allowable take, if sex ratios were shifted to favour females and hence increase productivity by means of a "male only" hunting law.

The Kaminuriak herd appears to have declined from 150,000 or more to about 35,000, and there seems little chance of re-establishing its former abundance unless harvests and losses to predators are maintained well below recruitment rates for a period of years. Since recruitment declines as standing crops decline, rapid and effective action is required now to reverse the current trend. The Beverley herd is in the initial stage of a decline, and although the situation is not yet as critical as that of the Kaminuriak herd, corrective action taken early will be less painful than corrective action taken after a decline is in full swing.

In Report No. 4 the Science Advisory Board pointed out that the most serious short-coming in the management of barren-ground caribou is lack of reliable harvest records. Not until reliable (± 5% accuracy) and consistent records are kept, can the data acquired from the ongoing population monitoring program be put to maximum use. The current practice of issuing General Hunting Licences for 5 years has even eliminated the possibility of interviewing hunters once a year at the time of licence renewal. This yearly interview formerly provided the information on each hunter's bag for the previous year. The abysmal performance of all agencies responsible for hunter kill data (for all species) cannot be stated too strongly. However, the initiative taken recently by several

wildlife officers, who have conducted regular interviews with all hunters (i.e., Coppermine data for 1979), shows promise for the future. Efforts must be made to expand this practice to all communities for all resource species.

WOODLAND CARIBOU

The status of woodland caribou in the Northwest Territories is poorly known. Their approximate range has been documented but no attempts have been made to learn their seasonal distribution, density or population size. Woodland caribou are hunted both by resident hunters of the forested regions for meat, and by non-resident hunters in the Mackenzie Mountains for trophies. Their overall contribution to the domestic economy of the Northwest Territories is minor compared with that of barren-ground caribou or moose. Their secretive habits make woodland caribou a difficult animal to study and also contribute to difficulties in management. We do not give research or management initiatives in woodland caribou a high priority at the present time.

PEARY CARIBOU

This form of caribou occupies the high arctic islands where it is hunted from the communities of Grise Fiord, Resolute Bay, Cambridge Bay, Holman Island and Sachs Harbour, and to a lesser extent from Spence Bay and Gjoa Haven. Studies of caribou on the high arctic islands suggest that annual migrations occur between islands. Peary caribou also move from island to island in response to environmental conditions. Despite such movement, significant differences in population characteristics exist between regions of the high arctic.

Management of Peary caribou on a sustained yield basis may be difficult if not impossible over most of their range. Several features of the region and the caribou contribute to this. Severe and drastic winter die-offs are known to occur. The population of Bathurst Island is recovering very slowly from the severe winter of 1973/74. Another factor is lack of understanding of the regularity or extent of inter-island movement. With the exception of those on Banks and Victoria Islands, populations of Peary caribou are sparse and small. The Banks Island population has been described in reasonable detail, but the caribou on Victoria Island remain unstudied despite the dependence of the people of both Holman Island and Cambridge Bay on those caribou for much of their domestic meat supply.

With the exception of the Victoria Island caribou population, we recommend that hunted populations be monitored regularly to detect major shifts in concentration and/or drastic declines. In the case of Victoria Island, extensive surveys should be conducted to determine population size and seasonal distribution. Once that is determined a monitoring program should be all that is required.

MOOSE

Moose range over all of the forested Northwest Territories and occasionally foray out onto adjacent tundra. The life history and ecology of this species is well understood from research conducted on it throughout the boreal regions of the northern hemisphere. The specifics required for management in the Northwest Territories however have not been addressed. The distribution of suitable winter habitat is generally known for the Mackenzie Valley, however current moose densities and population sizes remain to be determined for most of the 400,000 km² of potential moose range readily accessible from Mackenzie Valley communities. If published mean densities for specific regions are assumed for the valley and adjacent uplands, then the total number of moose in the Northwest Territories ranges between 20,000 and 52,000 (Table 4).

A conservative harvest rate of 6% applied to this population would yield an annual harvest of between 1,200 and 3,120 animals. Data on the current harvest are incomplete and do not provide a measure of the annual harvest relative to the sustained yield. Nevertheless, areas around settlements are probably harvested beyond the sustained yield while moose in more remote areas remain unharvested.

It is difficult to explain the decline in reported moose kills between 1963 and 1976. From cursory examination of the estimated population size it is unlikely that it represents over-harvest of a depleted population. It may reflect an increasing degree of unreported kills; or it may be that densities have decreased, with the result that greater effort is required to secure a moose; or possibly the overall hunting effort has been reduced in the last decade.

If the dollar value of a moose harvested is $2,000 (as estimated by Decker and Mackenzie in a 1979 report for the N.W.T. Wildlife Service), the potential value from the meat, hide and handicrafts to Mackenzie Valley residents of a rudimentary moose management

program ranges between $2,400,000 and $6,240,000 dollars annually.

As with caribou, harvest statistics need to be refined to show location, date, sex and age of all moose killed. Surveys similar to those over the Liard Valley need to be extended to the hunting grounds of those Upper Mackenzie communities that rely primarily on moose for red meat.

Moose are known to be creatures of early stages of boreal forest succession that could benefit from a long term program of habitat manipulation, including controlled burning and logging. The beneficial effects of fire for moose need to be balanced against possible detrimental effects on fur-bearing species.

BISON

There are two bison populations in the Northwest Territories excluding those of Wood Buffalo National Park. The population of the Slave River Lowlands, currently numbering approximately 600 head, is infected with tuberculosis and brucellosis; both are harmful to humans. Furthermore, this population is subjected to outbreaks of anthrax. Nevertheless, this herd has been a significant source of red meat for both Fort Resolution and Fort Smith. Recent declines required that drastic management measures be taken. All hunting other than that by subsistence hunters was curtailed in 1977. Steps were also taken to reduce the wolf population in the area. The herd is not responding positively to these measures in that the harvest rate by General Hunting Licence holders far exceeds the recruitment rate of the bison.

Ranching of bison between the Slave and Taltson Rivers seems possible. The extensive grasslands there, combined with the relatively discrete geographical setting, should permit the amount of control required for a bison ranch. The well documented movement and distribution patterns lend themselves to herd control. A ranch should be able to maintain many more bison than now exist on the lowlands between the Slave and Taltson Rivers. If mortality from predation and disease were controlled, a breeding herd of 3,000 would be possible. Such a herd, with a regulated sex ratio of one male to four females, could produce an annual surplus of 1,000 carcasses (based on a natality of 85 calves/100 adult cows), and still allow for an annual loss of 200 head to natural and other causes. The edible product, from 1,000 carcasses killed as 2-year-olds, could be as high as 150,000 kg of red meat (330,000 lbs.). The controlled use of fire to expand the prairies might permit a larger population if one were desired. If a program to restock the Slave River Lowlands is undertaken, we strongly recommend that the small diseased bison herd that now remains be eradicated and be replaced with disease-free stock.

The herd at the source of the Mackenzie River near Fort Providence is the product of a transplant of 18 disease-free animals made in 1963, which has grown at near the maximum rate and stood at 645 head in 1980. Its current annual increase appears to be about 100 animals per year. Harvesting strategies should be developed and implemented when the herd reaches a predetermined size within the carrying capacity of its range. Consideration should be given to using disease-free stock to establish more bison herds in the Northwest Territories. The historic range of Wood Bison includes the Upper Mackenzie River Valley as well as the Liard River Valley.

It is too early to predict the number of bison, were they to occupy all of the range available to them. Were this to be realized the meat and recreational potential for residents and non-residents of the Northwest Territories would be considerable. The cash value of a free-ranging population of 5,000 animals harvested at an annual rate of 5% could reach $500,000 annually ($2,000 per harvested bison is a conservative estimate). Barring limitations from range, predation or disease the Fort Providence herd could exceed 5,000 head within 15 years.

MANAGEMENT NEEDS

Research efforts to determine the extent of suitable bison habitat should be initiated and continue in anticipation of expected population growth. This program should identify locations suitable for future introductions of disease-free bison similar to the 28 animals released near Nahanni Butte in June, 1980.

MUSKOX

Muskox, like polar bear, are hunted only under quota by a person holding a General Hunting Licence or a person who receives a muskox tag issued to him on the advice of the local Hunters' and Trappers' Association. Muskox are hunted both for their meat and for the trophy value of their head and hide. The life history of muskox is well understood as are the parameters affecting population growth and decline. Muskox have made a remarkable recovery from their near extirpation of the late 19th century on the mainland and arctic

islands. The total protection given them in 1917 promoted this recovery to the point where limited hunting was permitted in 1969. At that time Grise Fiord was assigned an annual quota of 12 animals. Since then quotas have been allocated to Sachs Harbour, Paulatuk, Cambridge Bay, Holman Island, Coppermine, Bay Chimo, Bathurst Inlet, Gjoa Haven, Spence Bay, and Resolute. The total quota for 1979/80 was 252. In all cases quotas were supported by population data. As additional data are obtained, especially from populations that are not now hunted (Ellesmere Island and Axel Heiberg Island), quotas should increase and may reach 1,000 per year. In the case of Banks Island and the Queen Maud Gulf area, strategies must be devised to ensure that all the spoils of the hunt are returned to the settlements so that the hunt becomes financially self-supporting.

MANAGEMENT NEEDS

The basic life history and population characteristics of muskox are known. Because the beast is primarily sedentary in its annual cycle, in contrast to the migratory caribou, it is easier to monitor. Also, unlike barren-ground caribou, muskox appear to be relatively immune to large-scale predation, but like Peary caribou they can succumb in large numbers to severe icing over winter pastures. This condition not only causes significant winter mortality, it may result in total lack of reproductive success in subsequent years. For those populations that are hunted, sex and age structure should be determined and monitored to detect changes that may occur in response to hunting.

Populations that are being hunted at or near their sustained yield must be monitored in the spring of every year in order to detect the possible effects of the preceding winter.

A strongly held view among many Inuit hunters is that there is significant competition for food where Peary caribou and muskox share winter range. If the monitoring program reveals evidence suggesting that either species is restricting the winter range of the other, these conditions should be confirmed by further study, and a cropping program must be developed to prevent serious population declines of either or both species in the event of extreme snow and icing conditions on their winter range.

GRIZZLY BEAR

This big game species is hunted for its trophy value in the Mackenzie Mountains and for its pelt around the Mackenzie Delta. Outside of those areas probably more grizzly bear are killed because they are perceived as a threat around camps rather than through active hunting. The so called barren-ground grizzly, found on the mainland in a broad band roughly following the treeline, should be considered a rare species due to its low density in a huge territory. It is not rare due to overhunting, mismanagement or habitat degradation. If mineral exploration and production is expanded and accelerated, the number of nuisance bears of all species, but most especially grizzly bear and polar bear, will increase. Current research into methods of deterring bears from approaching and occupying camps should be intensified in the interests of both man and bear. Beyond that the role of grizzly bears in the current economy of the Northwest Territories does not warrant an expensive and time-consuming study in the immediate future.

DALL SHEEP

Dall Sheep occur in the Northwest Territories only in the Mackenzie, Selwyn and Richardson Mountains — all the extreme western Northwest Territories bordering the Yukon Territory. The sheep population in the Richardson Mountains near Aklavik is heavily used by that community from time to time. Sheep are hunted in the Mackenzie and Selwyn Mountains primarily by non-resident trophy hunters. Whereas the income from these hunters produces significant revenue and results in cropping considerable amounts of meat, little of the resulting cash flows through Mackenzie Valley communities. This pattern could possibly be changed if there were a greater participation by local individuals in the outfitting industry.

MANAGEMENT NEEDS

Despite the fact that the bulk of the benefits of Dall sheep harvesting flows outside the Northwest Territories, an active monitoring program must ensure that this species — very vulnerable to overharvest — remains a strong resource for the benefit of our economy in anticipation of a greater number of residents participating in the tourist industry. It is unlikely that sheep will ever play a major role in providing protein for northerners, nevertheless, the edible parts of those that are taken by non-resident hunters and not exported should by law be made available to residents in communities along the Mackenzie River.

MARINE MAMMALS

NARWHAL

The harvesting of narwhal was recently placed under quota by the federal Department of Fisheries and Oceans. The quota of 472 is made up of allotments ranging from 10 to 100 for each of 18 communities.

It is difficult to estimate the value of this species to the local economy. Muktuk remains a valuable commodity for local consumption while the tusk brings in cash whether sold as raw irovy or as ivory handicrafts. The price of raw ivory seems to vary with the size of the tusk. Prices at Pond Inlet range from $75 to $100 per kilogram.

MANAGEMENT NEEDS

Information presently available on the size of either the eastern high arctic or the Hudson Bay narwhal herds is inadequate for management for optimum returns. The current estimate of 20,000 to 30,000 is too imprecise to serve as a basis for anything except a conservative quota. This uncertainty, combined with lack of understanding of population age structure and reproductive capacity, further undermines the biological significance of current quotas. While the current quota, based on inadequate data, may be a useful stop-gap that may prevent overharvest, it does not, in itself, constitute a sound species management program. Until the basic information on population size and reproductive capacity is obtained the quota does not necessarily represent the potential sustained yield. Furthermore, the quota should reflect mortality due to unretrieved hunting losses. Efforts to reduce such losses should continue and when a real reduction in the loss rate can be demonstrated, the quota should be increased accordingly.

The imposition of a quota on polar bear and muskox resulted in improved harvest statistics. Although the harvest statistics for narwhal landed are already reasonably good, the quota system will probably improve them in addition to providing improved data on hunting losses. These data should be shared with Greenland because part of the eastern arctic narwhal herd hunted in Canadian waters is undoubtedly also hunted in Greenlandic waters.

BELUGA

Unlike narwhal, belugas are harvested in the western arctic as well as the eastern arctic and Hudson Bay. In both areas the available population data are better than for narwhal. Unfortunately, the inter-relationship between the several herds in the eastern arctic and Hudson Bay remains poorly documented. Also, the relationship between Canadian and Greenlandic stock, if any, is poorly, understood.

The population dynamics of beluga have received considerable attention but the age-specific aspects of their reproductive biology remain the subject of debate. Not until the debate is settled can a detailed management program be implemented for the 24-28,000 belugas that occupy arctic waters (Davis et. al., 1980). The reported annual harvest in the Northwest Territories is about 550 animals or roughly 2% of the standing crop, well within the probable calf recruitment rate of 9 to 12%. Despite the apparent safety margin, we cannot assume that the sustained yield is 9 to 12% since natural mortality has not been quantified. Also, Quebec and Greenland together take more than 1,000 belugas annually. The effect of Greenland's harvests on the Canadian beluga population is also not understood.

The harvest of the belugas occupying Cumberland Sound has been monitored over a long period. Commercial whaling by the Hudson's Bay Company terminated at Pangnirtung in 1956. During the period of commercial whaling the annual take was approximately 10% of the estimated population. Despite the elimination of commercial whaling the population has steadily continued to decline. This population, which is probably isolated from other beluga groups, may only be able to recover to its former size through reduced annual mortality. The most effective measure would be to relieve the hunting pressure imposed by Cumberland Sound Inuit. While such a step would result in certain economic hardships on Pangnirtung in the short term, it would have distinct benefits in the long term if it permitted the stocks to recover to their former size.

MANAGEMENT NEEDS

Present methods of determining the age of a beluga do not give absolute age with certainty. Development of a new method of age-determination would permit much of the existing data on arctic beluga populations to be incorporated into a species management plan almost immediately. More information is needed about age, size and specific characteristics of beluga populations and the possible exchange of individuals or groups between eastern arctic and Greenlandic herds needs further study. The distribution of the eastern arctic populations in relationships with Greenland beluga herds needs refinement.

WALRUS

The status of walrus in the eastern arctic parallels that of narwhal. While their range is known, the sizes of local populations are not. Also, reproductive parameters are not understood in sufficient detail to permit an estimate of sustainable yield for use in a species management plan.

Current use of walrus seems to be a mixture of traditional and cash-based economics. The importance of walrus as a source of dog food has declined drastically due to reduction in the number of working dogs in the north. However, the growing market for ivory provides a monetary incentive to harvest walrus. The problems of losses (from sinking and wounding) are the same as for other marine mammals.

MANAGEMENT NEEDS

It seems quite clear that current walrus populations have not recovered from the large-scale exploitation that began during the whaling era and continued until the mid 1950s. Since the harvesting of walrus is likely to continue primarily in pursuit of ivory, then the fundamental questions of population size and reproductive capacity must be determined as the basis of a management plan designed to maintain the take within the sustainable yield.

Fish

FRESH WATER FISHERIES

The role of fish in maintaining the standard of living and contributing to the economy of the Northwest Territories should not be underestimated. Although there are few reliable data on the extent and volume of the domestic fishery, most communities in the Northwest Territories enjoy an abundant supply of high quality fish at most times of the year. Even communities in the high arctic, like Grise Fiord and Resolute Bay, where fishermen must travel considerable distances for fresh fish, value this resource equal to, or above, all others. A conservative estimate of the volume of the annual domestic harvest is 2.5 million pounds.

Commercial fisheries in the Northwest Territories contribute a significant amount of cash to the economy through the sale of fish for export or through inter-settlement trade and sales (Table 5). The Fresh Water Fish Marketing Corporation, under the Fresh Water Fish Marketing Ordinance passed in 1969, is responsible for marketing all fish exported from the Northwest Territories as well as controlling the sale of fish and fish products within the Northwest Territories. While permits to do so are readily available for sales and trading between entrepreneurs and fishermen in small settlements, retailers in the larger settlements (i.e. Yellowknife) have to date been prevented by the Ordinance from buying fish directly from the producer. They must buy instead from the corporation and pass on the additional cost to the consumer. In the case of arctic char landed in Cambridge Bay this could amount to $1.00 per pound. It is difficult to imagine how this aspect of the Ordinance contributes to the well-being of the producer or the consumer.

Generally the development of an expanded commercial fishery in the Northwest Territories does not lack for fish, quotas or markets. Table 5 summarizes Northwest Territories commercial fishing quotas set by Fisheries Canada. The current commercial quota is 5.9 million pounds, while the harvest for 1978 was just over 3 million pounds. It is obvious that commercial fisheries in total can be expanded considerably before reaching assigned quotas. The potential of fisheries in the Northwest Territories far exceeds the published quotas. A rough rule of thumb for developing preliminary quotas is to assume a production of 0.5 lb. per acre of water surface per year. Applied only to those lakes with a surface area greater than 36 square miles (51,000 square miles in total in the Northwest Territories), the potential harvest is 16,320,000 pounds annually.

Although such a crude analysis should not be used to actually manage the resource, it does provide an indication of the tremendous potential of lake fisheries in the North. In combination with the potential of the Mackenzie and other large northern rivers, it seems clear that the productive limits of northern fisheries would not be taxed in the foreseeable future if the fishing effort were more widely distributed.

Sport fishing in the Northwest Territories is also an important aspect of the total fisheries management program. Species most sought after as trophies are Arctic Char, Lake Trout and Grayling. Other species, like Northern Pike and Walleye are important recreational fish pursued less vigorously for their trophy value by tourist fishermen. Few data are available on the dollar value of the sport or trophy fisheries in the Northwest Territories. Furthermore, since many tourist establishments catering to the trophy fishermen are southern based, it is difficult to estimate the contribution to the territorial economy.

The steady growth of establishments catering for anglers during the past 10 years is an indication of the economic potential of sport fishing. It must be noted that the resource cost in trophy fish is low compared to the net inflow of cash in a sport fishery owned and carefully managed in the northern interest.

RECOMMENDATIONS

TO SCIENTISTS

1. In order for the optimum benefits of fisheries to be realized in the Northwest Territories, more information is needed on fisheries within economic reach of communities. Despite the considerable amounts of data collected on char populations, in Diana River and Nettiling Lake for example, the real commercial potential of these systems remains unknown. Also it is known that the Mackenzie River supports fish populations of considerable size. Considering the ease with which catches could be marketed through Hay River, it should be a high priority to stimulate a commercial fishery there.

2. The high marketability of arctic char should encourage research into the feasibility of rearing char in warmer bodies of water in the southern territories, following the example of 'trout farming' in prairie potholes. Aqua culture in the Mackenzie Valley could provide both additional employment and income from pursuits suited to the talents and interests of many northern residents.

TO MANAGERS

1. Develop a data gathering system that provides data on all fish harvested in the Northwest Territories, whether for domestic, commercial or recreational use.

2. Develop a strategy that permits commercial fishing of remote lakes. Transportation incentives are provided through the "tote trail" program for opening winter roads to support mining projects. The guidelines for that program do not preclude seasonal fisheries from applying for a share of the $125,000 available annually to assist in the transport of fish through construction of docks, airstrips, or seasonal roads. Perhaps a separate program might be developed for commercial fisheries that would reduce transportation costs for producers on remote water bodies.

TO LEGISLATORS

1. Amend the Fresh Water Fish Marketing Ordinance to allow local merchants to purchase fish directly from producers operating certified plants.

2. Promote, through legislation and public awareness, knowledge of the economic potential of northern fisheries.

3. Encourage more northern residents to participate in the lucrative trophy fishery as managers and operators. Ideally, this can be done through discussion and debate rather than legislation although the latter should be considered as an option.

MARINE FISHERIES

Despite our proximity to the sea, nowhere in the Northwest Territories is there an on-going marine fishery. The brief cod fishery at Port Burwell proved that high quality marine species occur and that a successful marine fishery there is possible. Also the potential for halibut and Atlantic salmon in Hudson Strait should stimulate further investigation into the size and range of those fish populations. Preliminary indications suggest that an annual harvest of 500 tons from Hudson Strait is possible. (Barry Jones — Makivik Corp., Fort Chimo, Quebec).

Greenlanders have demonstrated that shrimp populations in Davis Strait can support a successful fishery. Initial findings of investigations into the productivity and distribution of shrimp in Davis Strait indicate that the Canadian portion of the strait could produce 2,000 tons annually. At the current price of $1.70 per pound for dressed shrimp the gross revenues could reach $3,400,000 annually.

The Beaufort Sea has long had a 1.3 million pound fish quota in place. As yet no attempts have been made to exploit it. As with the other potential marine fisheries, the amount of capital required to establish this fishery has discouraged individuals from taking a long term entrepreneurial plunge despite the long term returns from a properly managed renewable resource.

SUPPLY OF AND DEMAND FOR EDIBLE RESOURCES

From the preceding summary of the status of the major resource species in the Northwest Territories, it is clear that some species are being harvested close to their biological limit while others are not. One theme however is common to all — the current level of information about stocks, harvests and population dynamics is inadequate to permit management of any species at the optimum sustained yield level. (For a discussion of optimum sustained yield Science Advisory Board Report No. 2, p.43; Science Advisory Board Report No. 3, p.70; Science Advisory Board Report No. 4, p.7). The following discussion on supply and demand for wildlife resources assumes that current shortcomings of harvest and biological data will be corrected and that management will result in an approach to the optimum sustainable yield.

One question that is often posed in discussions regarding northern wildlife is "are the resources sufficient to meet the needs of northern people?" To attempt an answer to that question we have estimated the current and potential harvests of fish and mammals, and expressed the result in terms of protein (Table 6). We also calculated an estimate (Table 7) of the amount of protein required to provide an "adequate" diet, as defined by Health and Welfare Canada, for the present human population of 48,818. According to these estimates, fish and mammals harvested at the current rate could supply sufficient protein for about twice the present population. At the current rate of increase in human numbers, that means until about the end of this century.

Under intensive management and carefully controlled harvests we estimate an upper limit of supply about five times the present demand (6.4 million pounds compared with 1.3 million pounds). But, Schaefer (1980) has shown that the native population of Frobisher Bay (and, by implication, other native populations) consume much more than the minimum "adequate" amount of protein.

If we adjust our estimate on the basis of Schaefer's figures, the current protein intake may be as high as 3.2 million pounds annually. On that basis, only intensive management would provide "country food" for a population twice as large as the current one. Without trying to attach unwarranted precision to our estimates, we can say with some certainty that the fish and mammal resources could provide sufficient protein for a human population no more than two to four times as large as the present one (100,000 to 200,000 people). Since the human population is doubling in about 25 years, the absolute limit will be reached in two doubling times, or about the year 2030.

While there is sufficient protein to support the traditional diet for the entire native population for the short term future, it cannot be accomplished by using traditional modes of transportation. For example, optimum distribution of the harvest will require extensive use of mechanized transport. Also, should native hunters and trappers return to extensive use of dogs, the amount of protein available to the human population will be sharply reduced and could drastically shorten the period during which the Northwest Territories has the potential of producing all of its protein requirements.

We wish to reiterate that to harvest the full potential will require a greatly expanded program of wildlife management, and a carefully regulated harvest — ensuring that hunting effort is spread more or less evenly over the range of the species harvested and not concentrated around settlements or along rivers and highways. We also point out that the potential for increased harvests of fish may be about ten times the potential for increased harvests of meat (Table 6). Will people eat that much fish, even if the potential harvest is realized? The ratio would be nearly 4 kg of fish for each kg of meat.

The alternative to an intensified management program is to replace locally produced protein with imported protein. Based on the conservative values listed in the footnotes to Table 6, the cost of replacing the current harvest of mammals with beef is at least $4.6 million. The current value of the commercial fishery ($2.5 million) plus an estimate of the value of the domestic fishery ($1.0 million) is $3.5 million. Thus, we arrive at an estimate of the value of the edible portion for the total current harvest of fish and mammals of $8.1 million.

Recommendations

Recommendations of a specific nature have been made in the discussions on the various resource species important to the resource harvesters in the Northwest Territories. The recommendations that follow apply in general to the overall development of the industry in the Northwest Territories.

1. An information system must be developed to provide accurate and up-to-date data on harvests by both domestic and commercial users.

2. A program must be developed to enable harvesters to operate in the hinterland, and to assist in bringing resources to consumers. Only by spreading the effort over the entire range of the species can harvests be expanded without exceeding the biological capabilities of the resources.

3. Long term research into factors contributing to the natural variability and distribution of resource species should be undertaken so that the manager has the ability to estimate in advance the productivity and distribution of resource species.

4. Federal and Territorial agencies that promote research, management and resource exploitation must co-ordinate their programs to a greater extent than at present. Also a greater effort must be made to retrieve and integrate data produced by university and industry personnel in the north.

5. Follow-up studies should be instituted for all incentive grants made to hunters and trappers in order to determine what level and type of incentive results in the greatest benefit to the recipient in terms of improved resource harvesting.

6. The training programs developed recently that seek to train northerners, especially natives, for careers in wildlife management, are a great step forward. These should be expanded to include and develop greater public awareness of wildlife management options at the community level.

7. Although we have emphasized the consumptive values of wildlife that are relatively easy to express in monetary terms, we are not unmindful that wildlife also provides rewards that can be reaped without killing or consuming the resource. Such esthetic and cultural values are difficult to bring into the economic calculus, but provision should also be made for protection of non-game species in any expanded management program.

TABLE 1

The Relationships Between Terrestrial Fur Harvest and Prices between 1957/58 and 1978/79

Species	Numbers				Dollars					
	Mean	Std. Dev.	Coeff. Var.	Max. Min.	Mean	Std. Dev.	Coeff. Var.	Max. Min.	Pearson Corr.	Spearman Corr.
Beaver	7,125	2,093	29	4.06	13.37	3.21	24	2.69	−0.47	−0.59
Fox-Cross	320	305	95	19.28	28.52	38.13	134	75.74	0.94	0.89
Fox-Red	678	584	86	27.74	20.61	25.16	122	59.08	0.88	0.79
Fox-White	23,367	10,379	44	6.06	18.65	8.49	46	4.25	0.14	0.08
Lynx	2,685	1,731	64	10.10	61.79	84.29	136	44.39	0.04	0.04
Marten[a]	11,052	4,635	42	6.04	13.46	7.61	57	5.89	0.48	0.14
Mink	5,555	2,587	46	7.29	20.36	5.07	25	3.18	0.22	0.17
Muskrat	169,688	60,861	36	6.00	1.56	1.15	74	9.54	−0.19	−0.23
Squirrel	15,597	8,876	57	8.01	0.47	0.28	59	6.25	−0.37	−0.46
Weasel	4,471	2,568	57	7.12	0.71	0.21	29	2.88	−0.26	−0.25
Wolf	510	346	68	20.35	49.35	53.88	109	40.55	0.69	0.79

[a] Correlations negative and insignificant for 20 years. Last two year's data produce weak positive correlations

Standard Deviation and Coefficient of Variation are precise statistical measures of the amount of variability in the data. For those not comfortable with statistics, the ratio of maximum/minimum conveys about the same information. In all cases, the larger the number, the greater the fluctuation. Correlation Coefficients are a measure of the strength of the association (or lack of it) between two variables (in this case, number of skins harvested and average price per skin).

TABLE 2

Comparison of Average Annual Catches, Prices and Total Value (in Constant Dollars)[a] of the Fur Harvests of Major Species 1957/58 to 1961/62 and 1972/73 to 1976/1977

Species	Avg. Annual Catch	Trend	Avg. Annual Price Per Pelt	Avg. Annual Value Current $	Avg. Annual Value 1971 $	Rank
			1957/58 - 1961/1962			
Seal[b]	30,729		8.99	276,254	345,317	2
White Fox	26,875		16.98	456,337	570,422	1
Muskrat	201,269		0.59	118,748	148,436	4
Marten	8,917		6.89	61,438	76,798	6
Polar Bear	481		51.81	24,921	31,151	8
Mink	7,125		20.13	143,426	179,283	3
Beaver	7,505		11.12	83,456	104,320	5
Lynx	2,434		9.82	23,902	29,877	9
Colored Fox	570		3.13	8,915	11,144	11
Squirrel	26,165		0.32	41,793	52,241	7
Weasel	5,391		0.67	17,956	22,445	10
				1,257,146	1,571,430	
			1972/73 - 1976/77			
		Trend				
Seal	36,119	+	18.04	651,587	501,221	2
White Fox	26,634	o	25.42	677,036	520,797	1
Muskrat	155,004	–	2.52	390,610	300,469	3
Marten	7,945	–	19.14	152,067	116,975	7
Polar Bear	414[c]		670.34	277,521	213,478	5
Mink	3,240	–	22.34	72,382	55,678	8
Beaver	4,591	–	15.16	69,600	53,538	9
Lynx	1,464[d]	–	117.24	171,639	132,030	6
Colored Fox	1,428	+	47.48	339,077	260.829	4
Squirrel	9,693	–	0.63	30,537	23,490	10
Weasel	2,568	–	0.91	11,734	9,026	11
				2,843,790	2,187,531	

[a] Based on Consumer Price Index 1971 = 100; Average for 1957-1962 est. = 80; average for 1972-1977 = 130

[b] Data for 1957-1960 inclusive not available, data presented are those from 1961-1966. The principle use of seal changed from a subsistence food to a cash source for the pelt during this period.

[c] Regulated by quota since 1967.

[d] Misleading comparison because the first period includes the increase to a peak and the second includes only the decline following a peak.

TABLE 3

Ranges of Trapper's Incomes ($)
1975/76 to 1977/78

Year	No. of Trappers	Total Fur Sold ($)	Numbers of trappers in income bracket					
			Under 400	400-1000	1,000-2,000	2,000-4,000	4,000-8,000	over 8,000
1975-76	3,415	2,772,302	1739	841	494	263	61	17
1976-77	4,089	3,860,065	2084	870	585	374	137	39
1977-78	3,679	3,411,496	2354	440	471	270	109	35

TABLE 4

Observed Moose Densities (animals/km²) in the Liard and Mackenzie Valleys

Region Surveyed	Density	Date	Source of Data
Liard Valley	.04	1978	Decker and Mackenzie 1979
Liard Valley	.13	1979	Donaldson and Fleck 1979
Mackenzie District	.05	1957	Flook and Bryant cited in Dickinson and Herman 1980

TABLE 5

Current Commercial Quotas (Round Weight) and 1978 Commercial Harvest of fish

Species	No. of Quotas	Pounds*	1978 Commercial Harvest
Arctic Char	80	772,500	359,016
Whitefish and Trout	17	3,720,900	2,677,774
Whitefish	7	192,000	9,458
Walleye	3	134,000	613
Trout	3	15,000	149
Burbot and Pike	3	30,000	nd**
Inconnu	2	12,500	nd
Cisco	4	40,000	nd
Herring	2	1,000,000	nd
	121	5,916,900	3,047,100

* Dressed weight is 80% of round weight
** nd is assumed to indicate that no commercial harvest was taken on that quota.

TABLE 6

Some Estimates of the Protein Content of Current and Potential Harvests of Fish and Mammals Used as Food

Source	Dressed Wt.	Protein Content	Current Harvest (1978/79)			Potential Additional Harvest (lbs.)		Potential Supply
			Number	Edible Wt.	Protein	Edible Wt.	Protein	Protein
				000's lbs (kg)	000's lbs (kg)	000's	000's lbs	000's lbs
Fish-freshwater[1]						8,320	2,150	3,885
Domestic	Round x 0.8	0.258	-	2,000	516			
Commercial	Round x 0.8	0.258	-	2,800	722			
Fish-marine[2]	Round x 0.8	0.258	-	-	-	800	206	206
Shrimp[3]	?	0.25	-	-	-	4,000	1,000	1,000
Total Fish				4,800 (2,200)	1,238 (563)	13,120 (5,952)	3,354 (1,520)	5,090 (2,310)
Seals[4] - ringed	31 lbs	0.32	20,601	640	205	NIL	NIL	204
harp	95	0.27	2,066	195	53	NIL	NIL	53
other	50	0.27	1,032	52	14	NIL	NIL	14
Beluga[5]	450	0.24	474	213	51	NIL	NIL	51
Narwhal[5]	425	0.24	472	200	48	NIL	NIL	48
Caribou[5]	100	0.27	20,367	2,035	550	360	97	650
Muskox[5]	200	0.25	252	50	13	NIL	NIL	13
Moose[5]	450	0.26	± 500	225	59	225	58	117
Bison[5]	510	0.25	± 30	15	4	622	156	160
Polar Bear[5]	175	0.26	600	105	27	NIL	NIL	27
Total Meat				3,735 (1,700)	1,023 (464)	1,200 (548)	311 (140)	1,335 (605)
Grand Total				8,535 (3,878)	2,260 (1,028)	14,330 (6,500)	3,665 (1,660)	6,425 (2,915)

1. Current market value at $.60/lb dressed weight
2. Current value imported at $.60/lb dressed weight
3. Current market value $1.70/lb dressed weight
4. Current market price FOB Frobisher Bay $.91/lb
5. Current value based on beef at $1.23 dressed weight wholesale FOB Edmonton

TABLE 7

Annual Minimum Requirement for "adequate" protein intake for 1980 Human Population of the Northwest Territories

Age	Daily Requirements (g)[a]	No. in Cohort[b]	Annual Demand (kg)
0-1	12.5 est	1,348	6,150
1-4	17 est	4,889	30,340
4-70 +	35 est	42,581	543,970
Totals:		48,818	580,460
			(1,278,000 lbs)

[a] After Health and Welfare Canada
[b] After Hamelin - 1979

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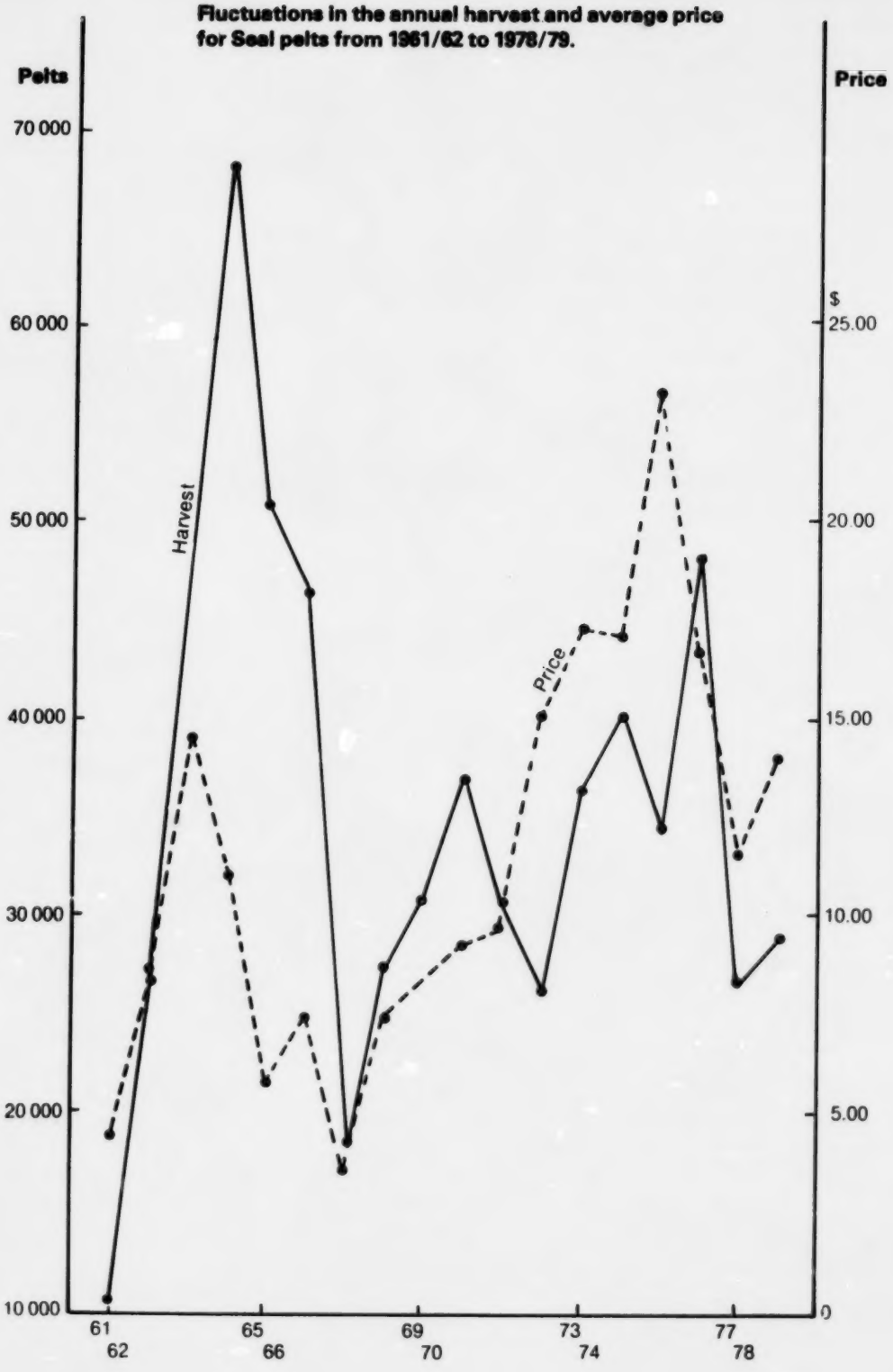
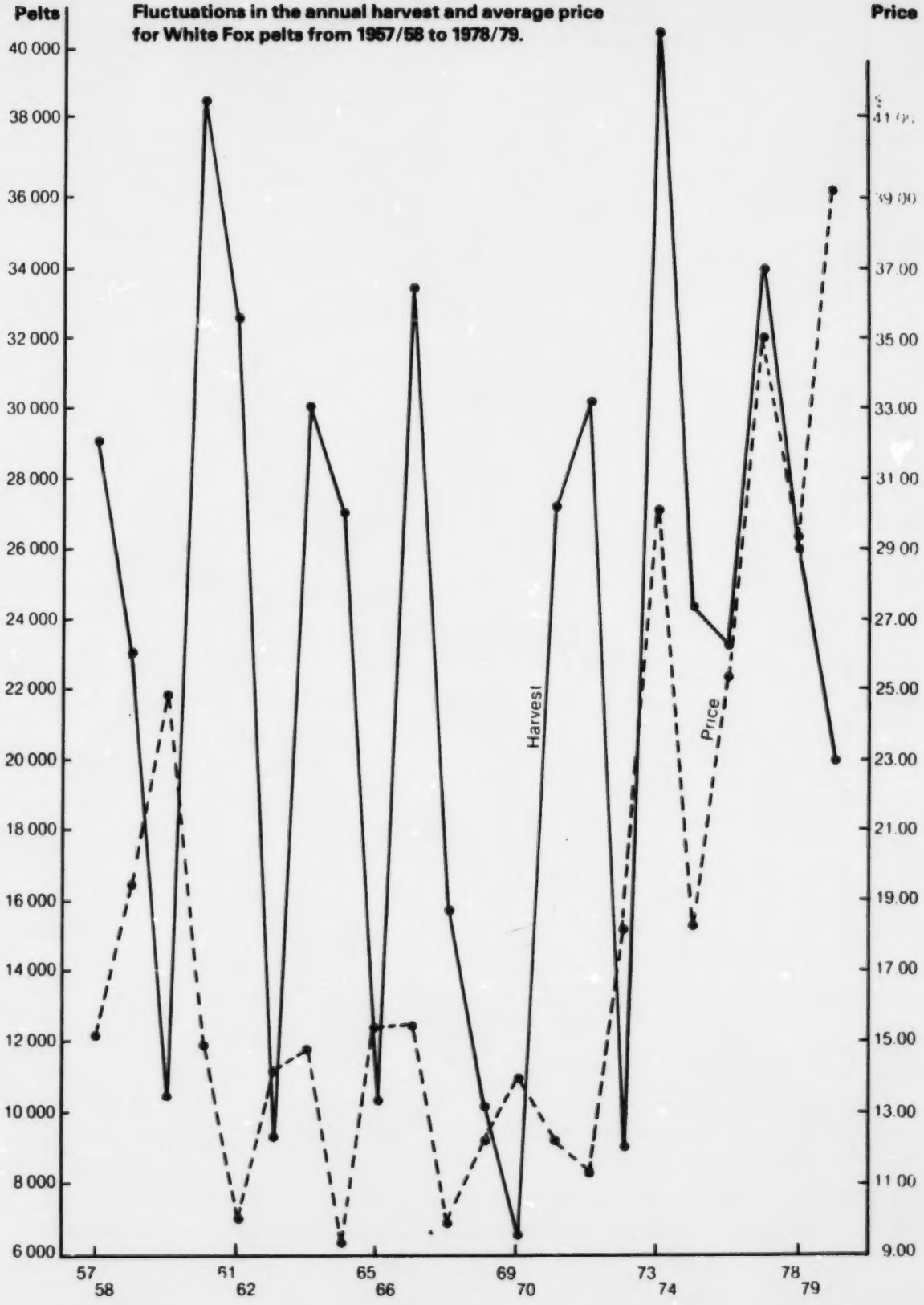
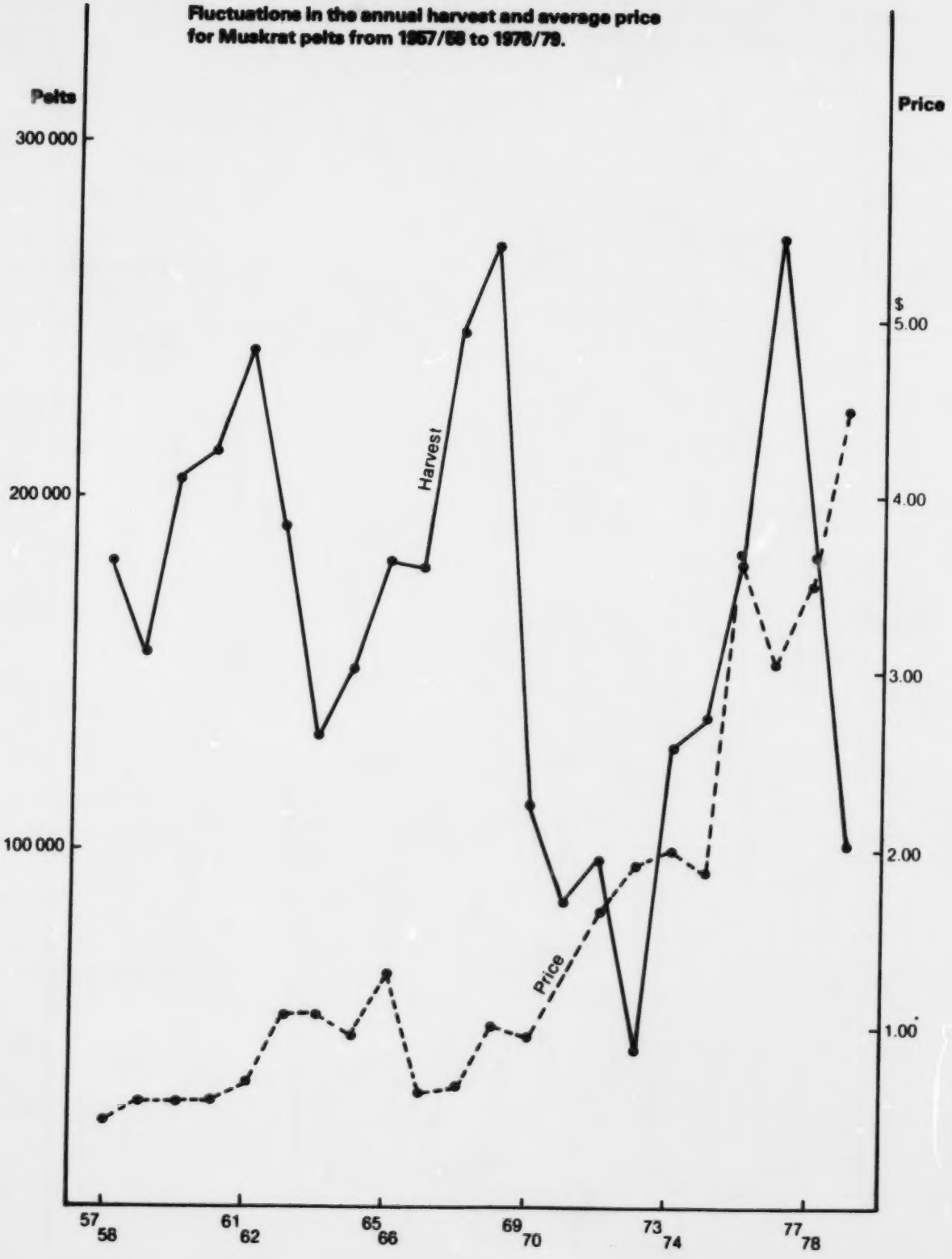
Appendix I

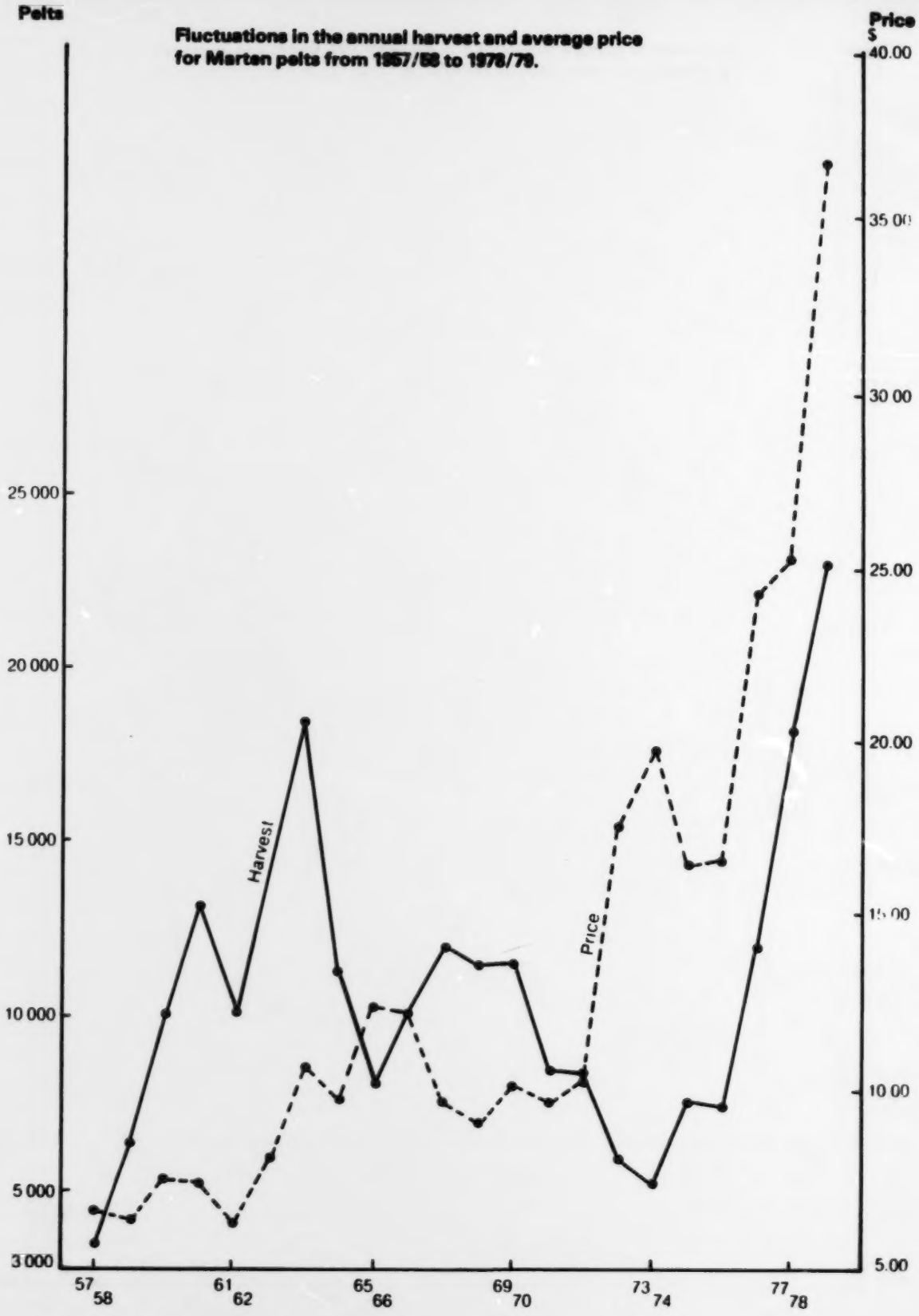
Fluctuations in the annual harvest and average price paid for major fur bearing species in the Northwest Territories — 1957 to 1978.

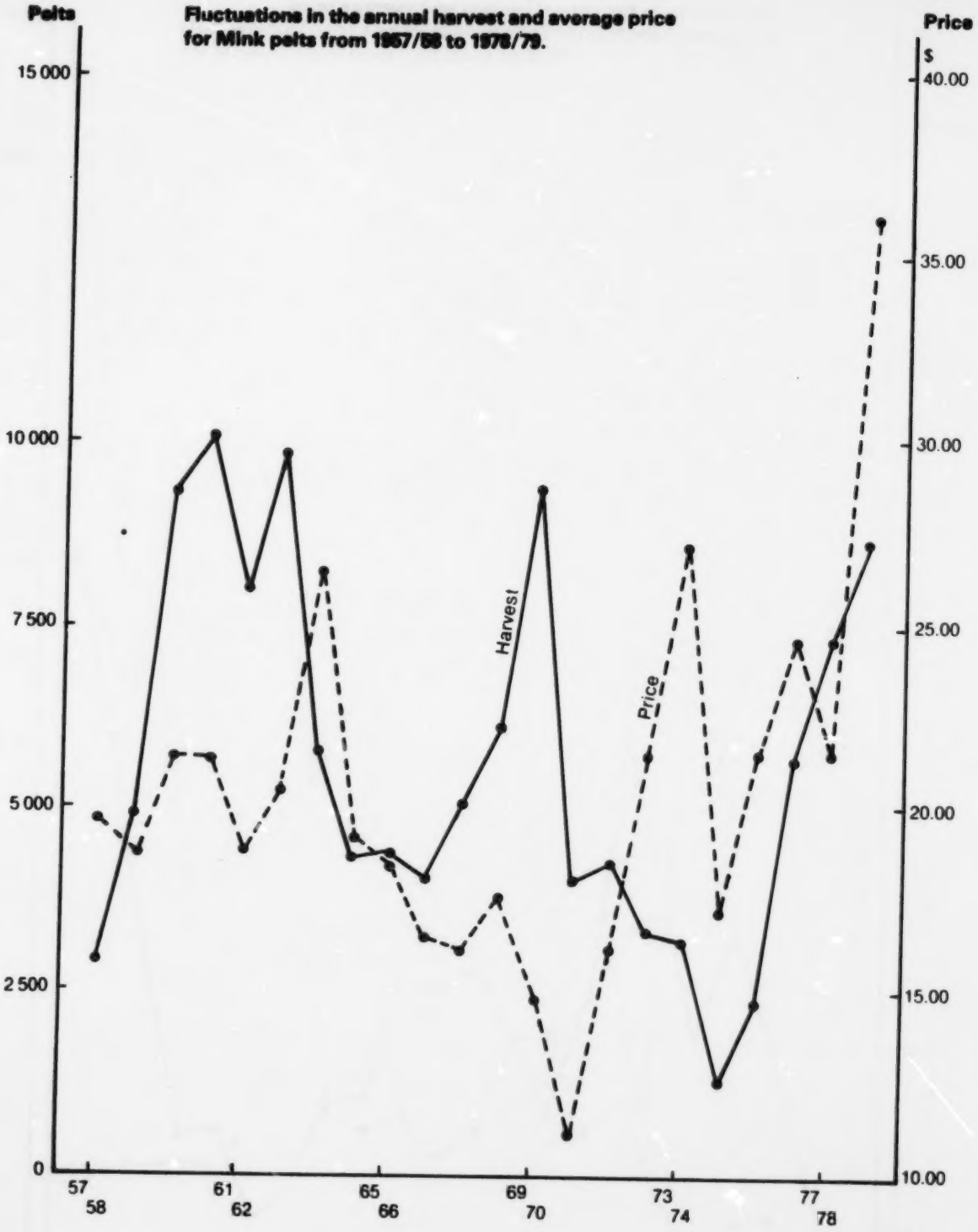
Fluctuations in the annual harvest and average price for Seal pelts from 1961/62 to 1978/79.




Pelts
Price
Fluctuations in the annual harvest and average price for White Fox pelts from 1957/58 to 1978/79.
40 000
38 000
36 000
34 000
32 000
30 000
28 000
26 000
24 000
22 000
20 000
18 000
16 000
14 000
12 000
10 000
8 000
6 000
39.00
37.00
35.00
33.00
31.00
29.00
27.00
25.00
23.00
21.00
19.00
17.00
15.00
13.00
11.00
9.00
Harvest
Price
57
58
61
62
65
66
69
70
73
74
78
79

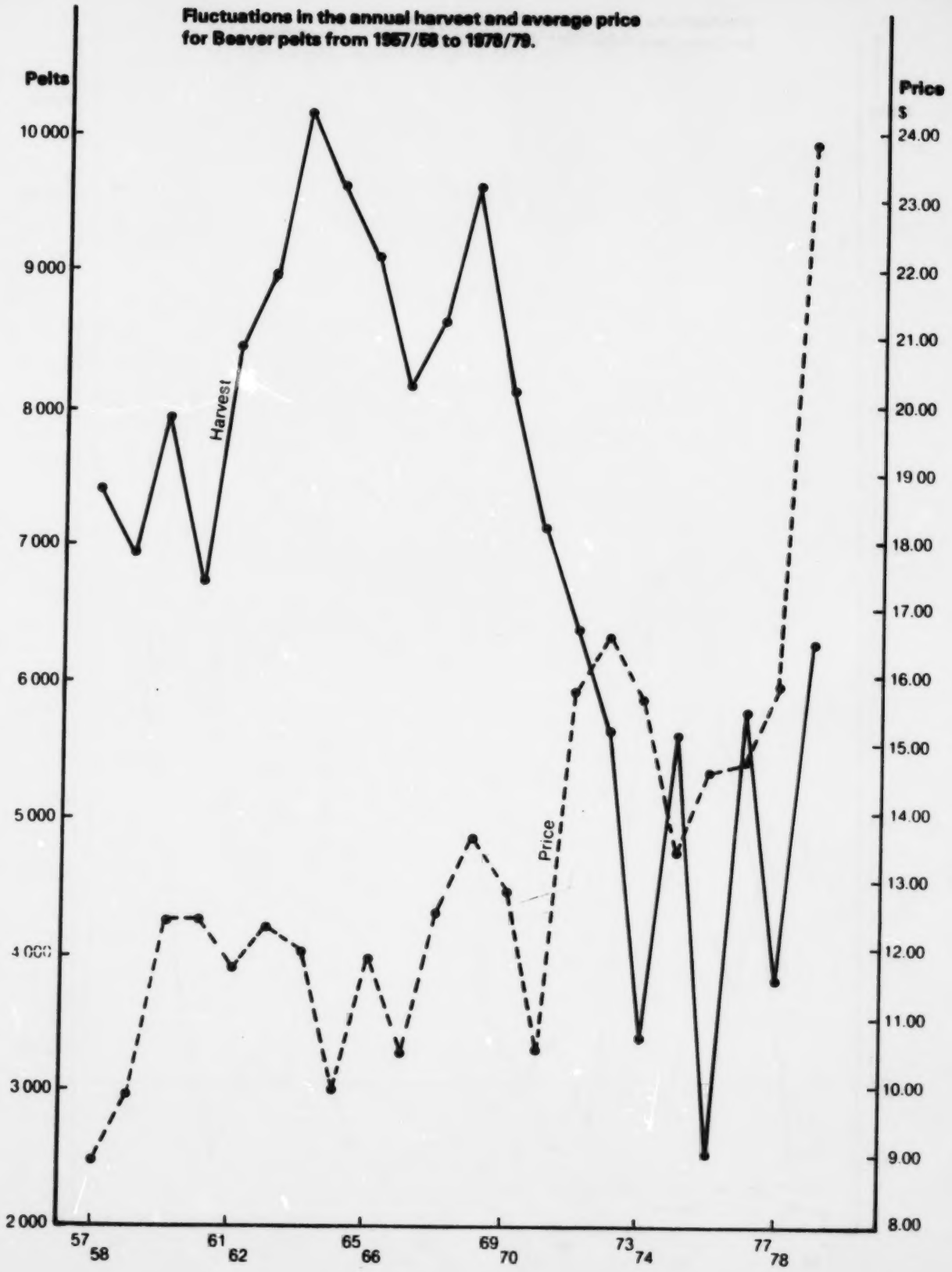

Fluctuations in the annual harvest and average price for Muskrat pelts from 1957/58 to 1978/79.
Pelts
300 000
200 000
100 000
Price
$
5.00
4.00
3.00
2.00
1.00
Harvest
Price
57 58
61 62
65 66
69 70
73 74
77 78


Pelts
Price
$
Fluctuations in the annual harvest and average price
for Marten pelts from 1957/58 to 1978/79.
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
25 000
20 000
15 000
10 000
5 000
3 000
Harvest
Price
57
58
61
62
65
66
69
70
73
74
77
78

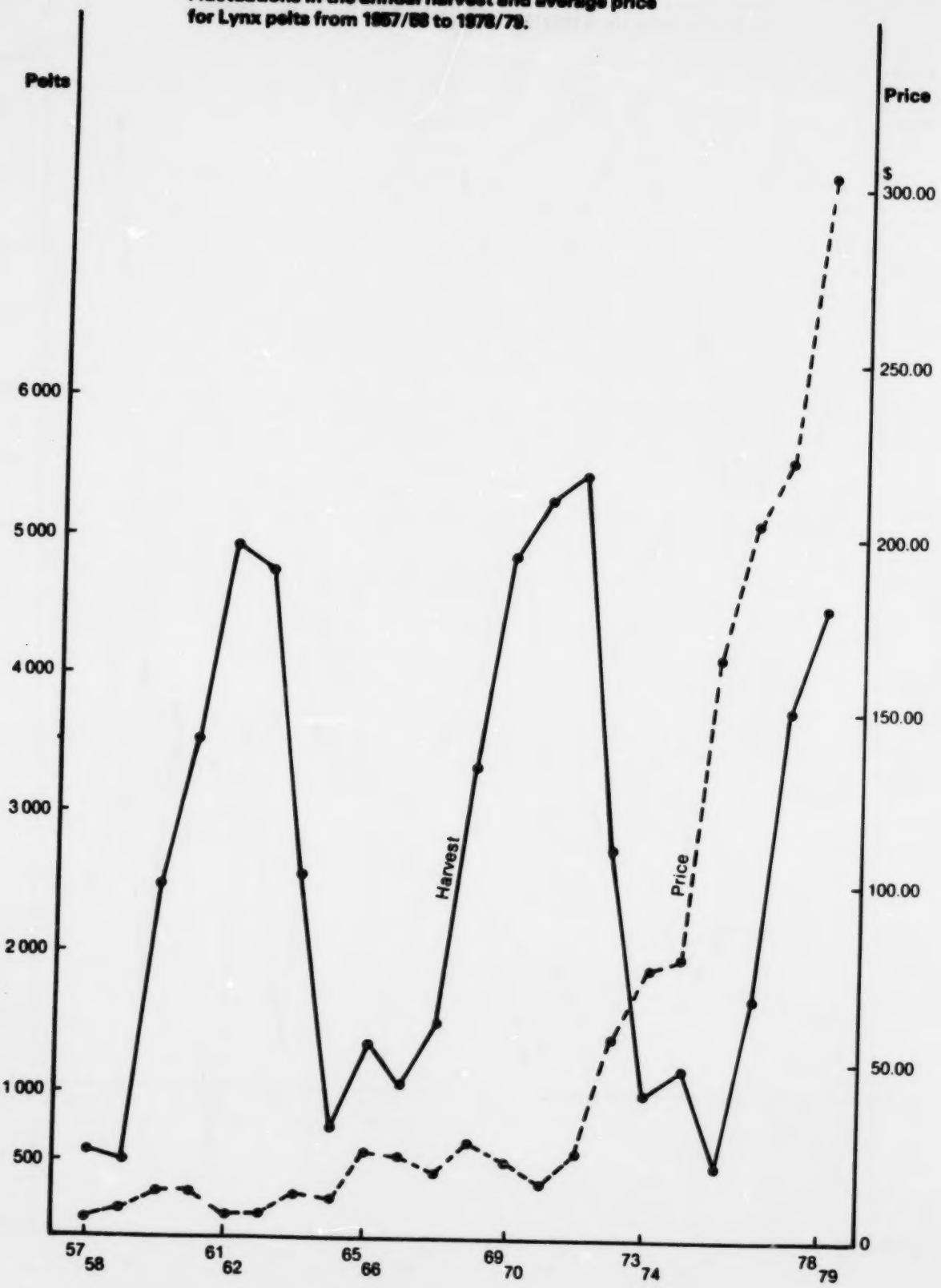


Fluctuations in the annual harvest and average price for Mink pelts from 1957/58 to 1978/79.

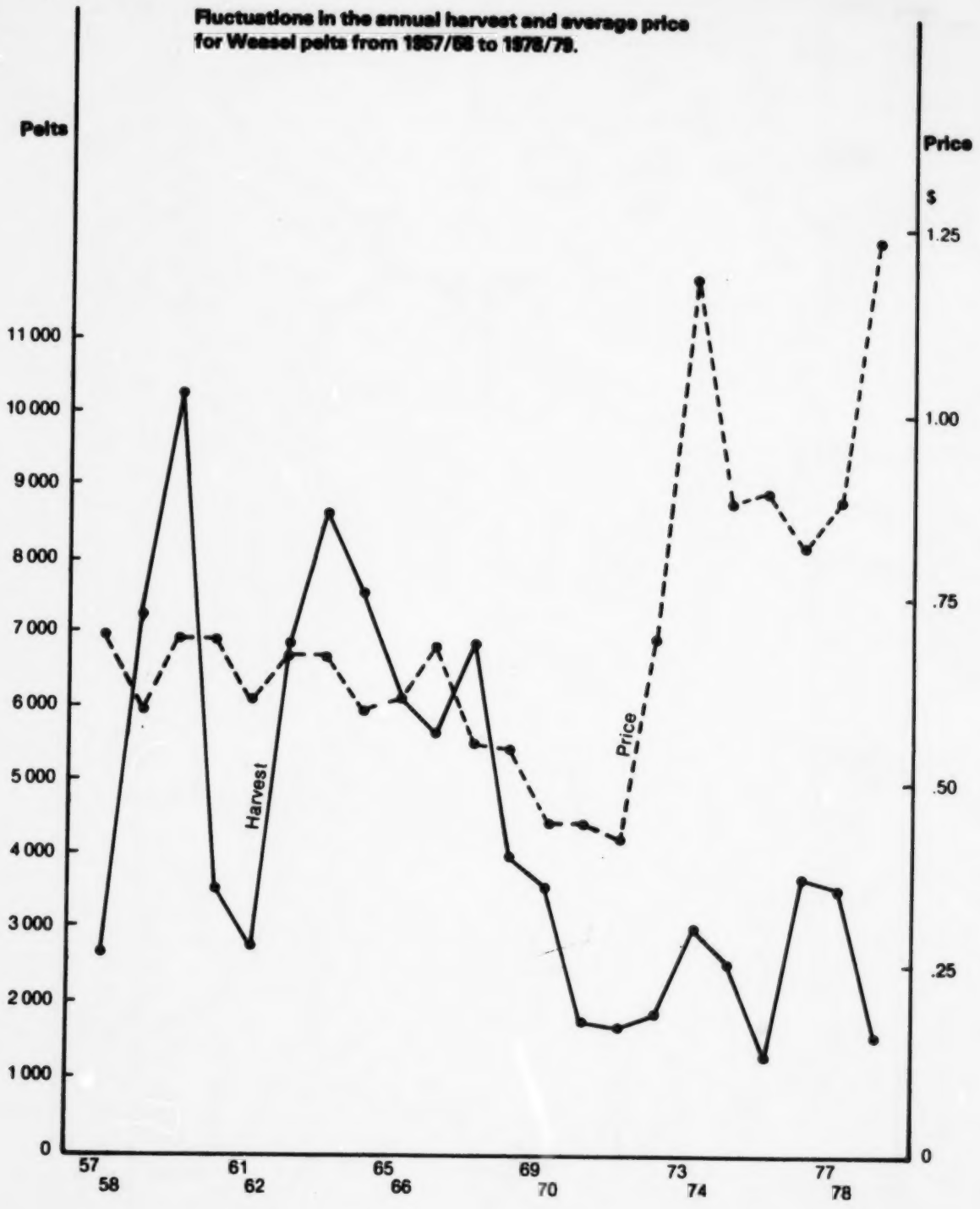
Fluctuations in the annual harvest and average price for Beaver pelts from 1957/58 to 1978/79.

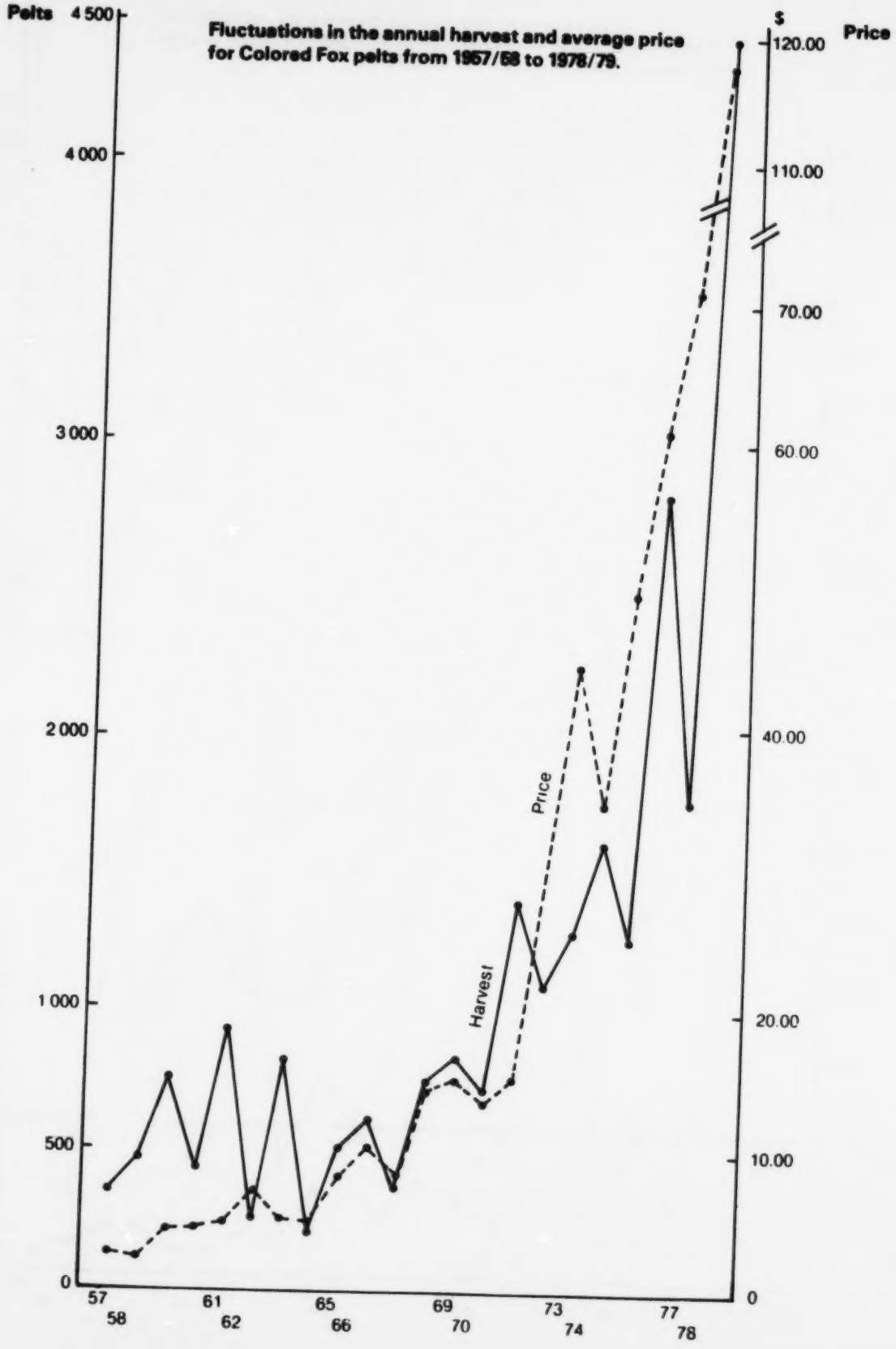


Fluctuations in the annual harvest and average price for Lynx pelts from 1957/58 to 1978/79.

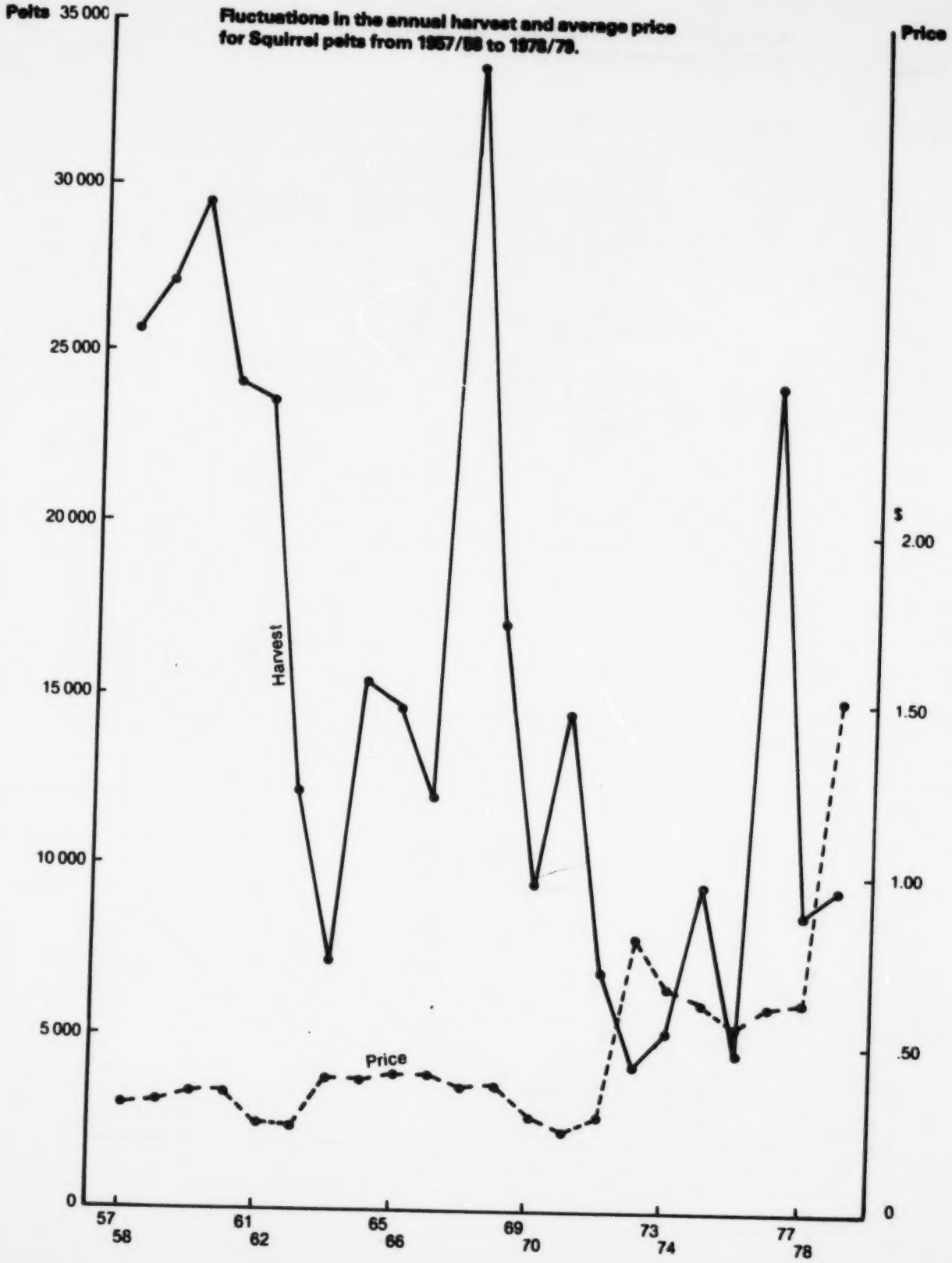


Fluctuations in the annual harvest and average price for Weasel pelts from 1957/58 to 1978/79.



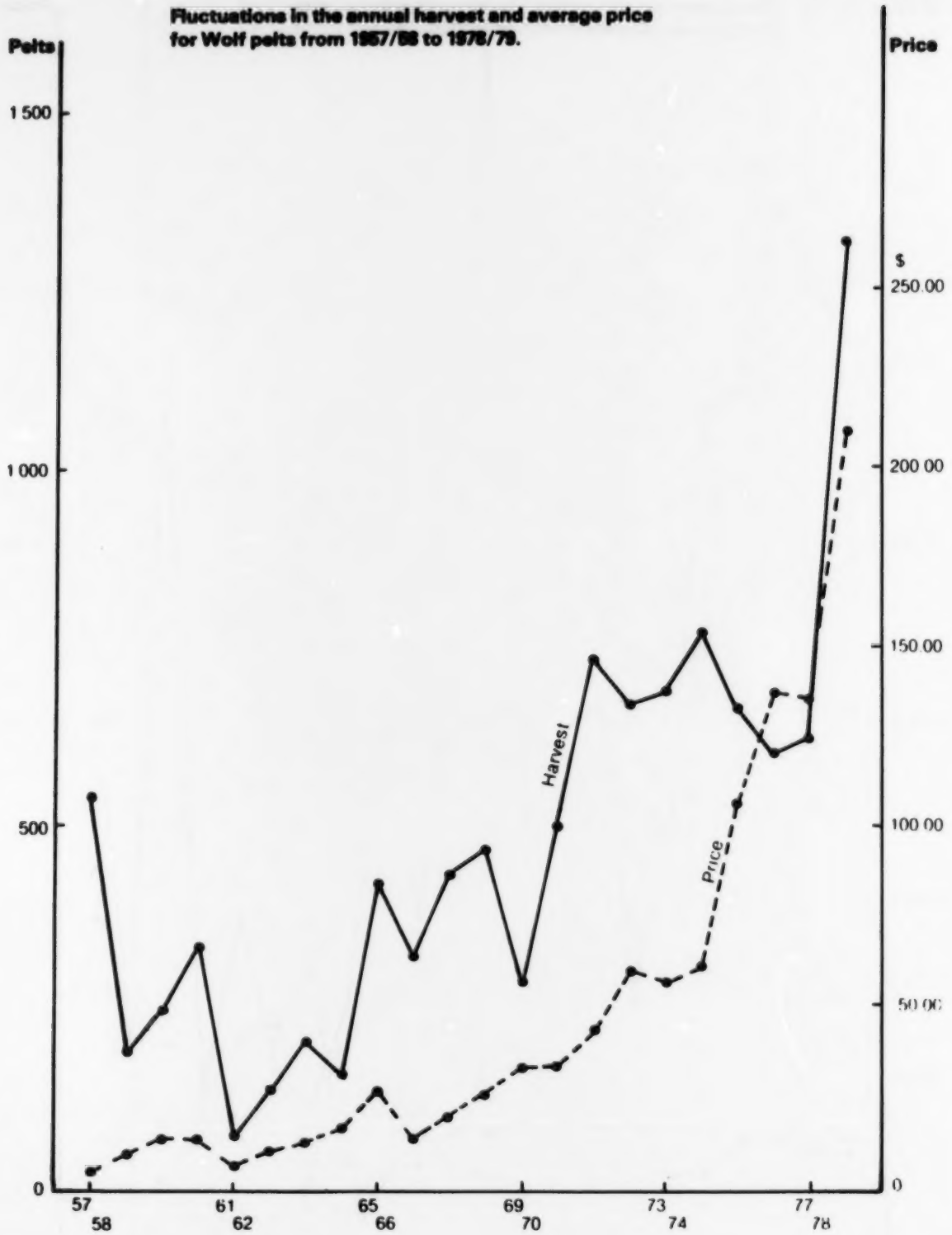


Fluctuations in the annual harvest and average price for Colored Fox pelts from 1957/58 to 1978/79.



Fluctuations in the annual harvest and average price for Squirrel pelts from 1957/58 to 1978/79.

Fluctuations in the annual harvest and average price for Wolf pelts from 1957/58 to 1978/79.



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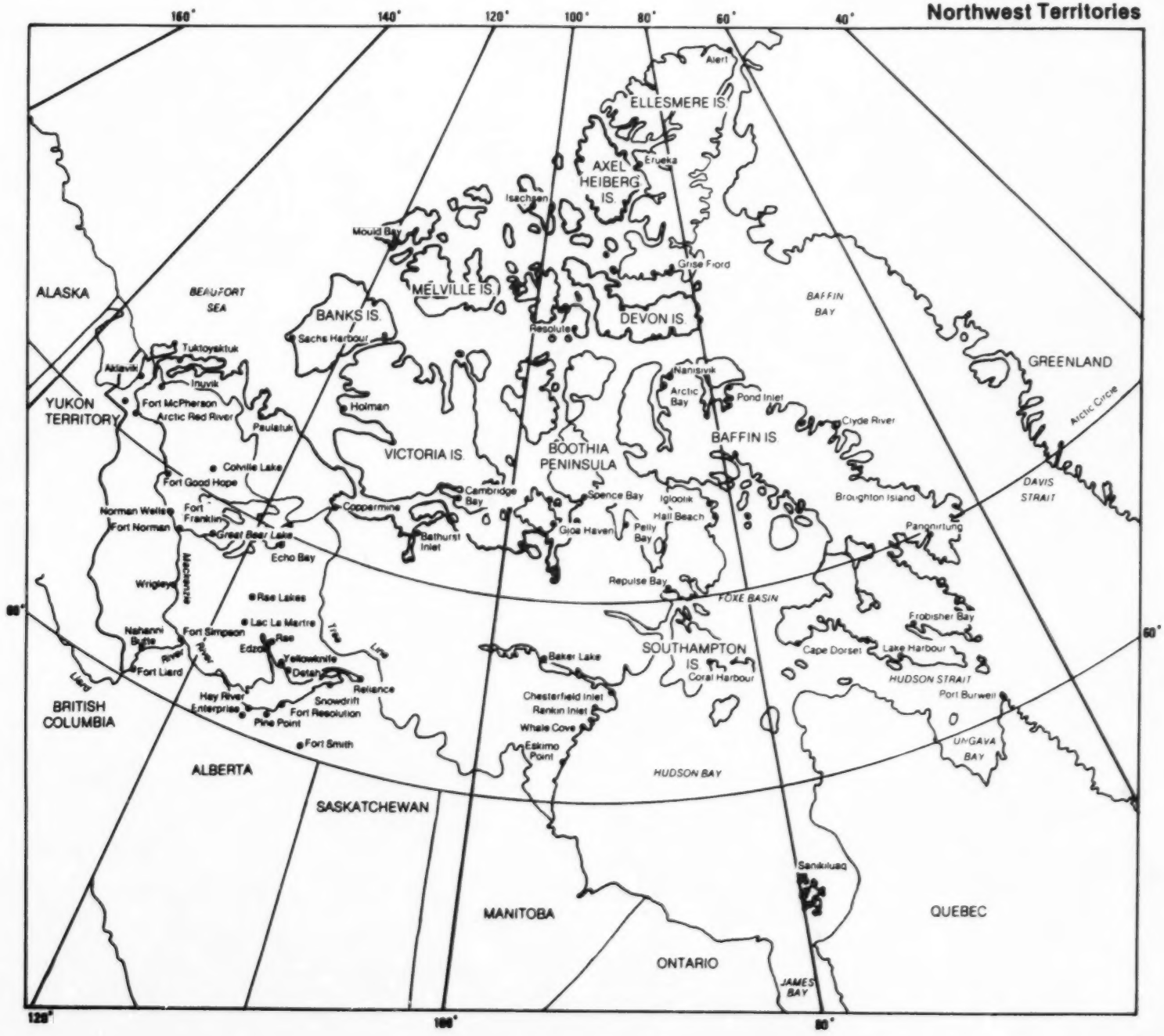
Northwest Territories
160°
140°
120°
100°
80°
60°
40°
ALASKA
BEAUFORT SEA
BANKS IS.
MELVILLE IS.
ELLESMERE IS.
AXEL HEIBERG IS.
DEVON IS.
BAFFIN BAY
GREENLAND
Arctic Circle
DAVIS STRAIT
BAFFIN IS.
VICTORIA IS.
BOOTHIA PENINSULA
FOXE BASIN
HUDSON STRAIT
HUDSON BAY
UNGAVA BAY
SOUTHAMPTON IS.
YUKON TERRITORY
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
JAMES BAY
Alert
Eureka
Isachsen
Mould Bay
Grise Fiord
Resolute
Sachs Harbour
Tuktoyaktuk
Aklavik
Inuvik
Fort McPherson
Arctic Red River
Holman
Paulatuk
Coppermine
Cambridge Bay
Spence Bay
Gjoa Haven
Bathurst Inlet
Igloolik
Hall Beach
Pelly Bay
Repulse Bay
Nanisivik
Arctic Bay
Pond Inlet
Clyde River
Broughton Island
Pangnirtung
Frobisher Bay
Cape Dorset
Lake Harbour
Port Burwell
Colville Lake
Fort Good Hope
Norman Wells
Fort Norman
Fort Franklin
Great Bear Lake
Echo Bay
Wrigley
Mackenzie
Rae Lakes
Lac La Martre
Rae
Edzo
Yellowknife
Detah
Trout Lake
Nahanni Butte
Fort Simpson
Fort Liard
Liard
Hay River
Enterprise
Snowdrift
Fort Resolution
Pine Point
Fort Smith
Reliance
Baker Lake
Chesterfield Inlet
Rankin Inlet
Whale Cove
Eskimo Point
Coral Harbour
Sanikiluaq
80°
60°
120°
100°
80°

POOR

QUALITY

ORIGINAL